



# WATERBURY

3, 2, 1, liftoff!  
The real-life  
Iron Man's jet  
pack dream

Seven ways  
to rebuild  
the global  
economy

Ideas | Technology **OF THE** Design | Business

# SPLINTERNET

How TikTok  
became the  
front line in a  
new Cold War



NOV | DEC 2020



# NO TIME TO <sup>007<sup>™</sup></sup> DIE

ONLY IN CINEMAS



NO TIME TO DIE © Danjaq and MGM. NO TIME TO DIE, <sup>007<sup>™</sup></sup> and related James Bond indicia © 1962-2020 Danjaq and MGM.  
NO TIME TO DIE, <sup>007<sup>™</sup></sup> and related James Bond trademarks are trademarks of Danjaq. All Rights Reserved.



JAMES BOND'S  
CHOICE



SEAMASTER DIVER 300M  
007 EDITION

Ω  
OMEGA





PRADA

LUNA ROSSA  
CARBON



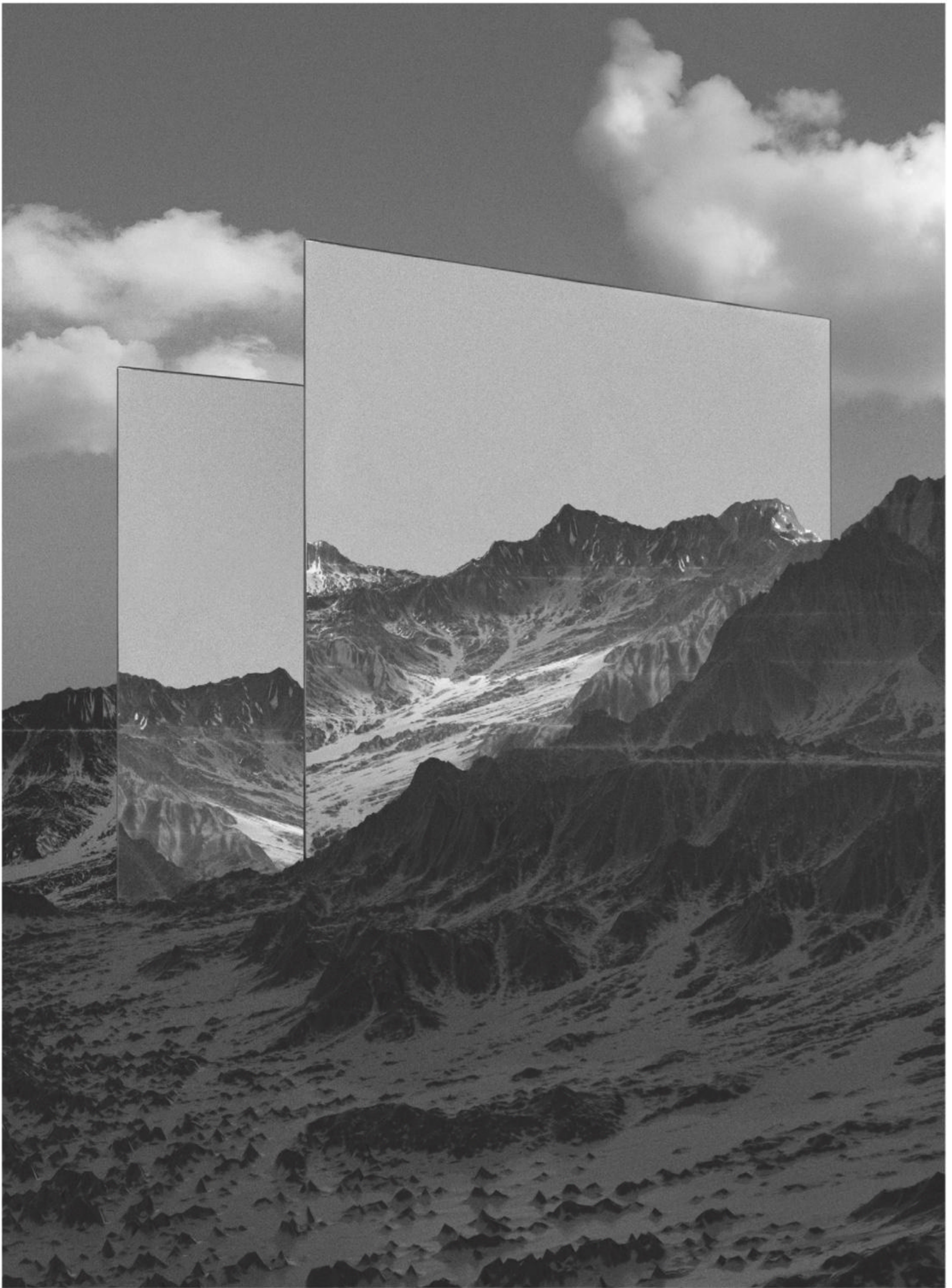


LUNA ROSSA

CARBON

#PRADACARBON









© Delfino Sisto Legnani

## ART INSPIRES TECHNOLOGY TECHNOLOGY COMPLETES ART

The form and function of the LG SIGNATURE OLED TV reveal themselves  
in a collection of minimal forms, shown in perfect harmony.

As **the world's first and largest 8K OLED TV**,  
it features an immersive 88" canvas for unforgettable picture quality.

# LG SIGNATURE

OLED 8K

Find yours at [LGSIGNATURE.com](https://www.lgsignature.com)





YOU  
DON'T  
BUY  
A  
SPORTS  
CAR  
TO  
BLEND  
IN



TOYOTA GR SUPRA



**Model shown is Supra 3.0 Pro. Official fuel consumption figures in mpg (l/100km): combined 34.4 MPG. Combined CO<sub>2</sub> 188g/km**

\*Figures are intended for comparability purposes; only compare fuel consumption and CO<sub>2</sub> figures with other cars tested to the same technical procedures. The fuel consumption and CO<sub>2</sub> produced under real life driving conditions will depend on a number of factors including the accessories fitted (post-registration), driving style, speed and vehicle load. All vehicles are certified according to the World Harmonised Light Vehicle Test Procedure (WLTP). CO<sub>2</sub> figures (and hence car tax and recommended 'on the road' prices) may differ from information printed before 1st April 2020, due to a change in the official method of calculation. Please visit [www.vehicle-certification-agency.gov.uk/fcb/wltp.asp](http://www.vehicle-certification-agency.gov.uk/fcb/wltp.asp) or contact your local Toyota Centre for more information.





PHOTOGRAPHY (COVER); SUN LEE. THIS PAGE: BENEDICT EVANS

**p. 120 Feature**  
**THE POST-COVID ECONOMY**

Joelle Gamble of the Omidyar Network believes that work isn't just about a paycheck – people need to feel valued, and that they are contributing to something





# Pureis<sup>®</sup> the first CBD food supplement clinically proven to be safe



First CBD food supplement to  
use FDA registered raw material



Pureis<sup>®</sup> CBD does not cause a “high” and is not addictive.

For more information about our products and clinical trials please visit [www.pureiscbd.com](http://www.pureiscbd.com)

[www.pureiscbd.com](http://www.pureiscbd.com)

p. 016 Start

THE ECHO CHAMBER

Artist May Safwat’s project uses the likeness of whistleblower Edward Snowden as a device to stop snooping digital assistants

*Right:* Gravity founder Richard Browning takes to the air, courtesy of his self-designed jet suit

p. 034 Start

SCIENCE’S SUPERHERO

When Marvel’s film makers need some smarts to save the day, British theoretical physicist Clifford Johnson comes to the rescue...

p. 045 Work Smarter

MAKE CHANGE

What organisations can do to champion workplace diversity, foster opportunity and empower employees to ensure real, impactful progress



PHOTOGRAPHY: SHAMIL TANNA

p. 057 Gear

DESIRED

Our annual round-up of the most luxurious essentials in WIRED’s world, from hybrid-luxe Audis to room-shaking speaker systems

p. 082 Feature

TIKTOK

The world’s favourite social-dance app has become the front line in a new Cold War between the US and China – but how did its dream sour?

p. 090 Feature

ARTEMIS

The Artemis missions will take astronauts to the Moon for the first time in decades – we explore the tech that will get them there

p. 100 Feature

BODY AND MIND

Neuroscientist Sarah Garfinkel’s work is revealing that the heart and body exert huge influence over the brain, and our emotional responses

p. 108 Feature

THEY PROMISED US JET PACKS

**Inventors have been trying to build jet packs for decades. Now, one has succeeded – but what are they for?**

p. 130 Feature

CITY LIMITS

From smart street crossings to vertical greenery, cities around the world are radically rethinking urban spaces – and how we live in them

Editor **Greg Williams**

Group creative director **Andrew Diprose**

Executive editor **Jeremy White**

Features editor **Victoria Turk**

Digital editor **James Temperton**

Deputy digital editor **Matt Burgess**

Senior editor **Amit Katwala**

Senior editor **Gian Volpicelli**

Business editor **Natasha Bernal**

Associate editor **Sophie Charara**

Science editor **Matt Reynolds**

Social media editor **Hollie Wong**

Staff writer **Will Bedingfield**

Staff writer **Alexander Lee**

Audience growth manager **Mike Smith**

Managing editor **Mike Dent**

Director of photography **Dalia Nassimi**

Acting director of photography **Kate Barrett**

Art director **Mary Lees**

Digital art editor **Kieran Walsh**

Video producer **Anna O'Donohue**

Contributing editors

**Dan Ariely, David Baker, Rachel Botsman,**

**Liat Clark, Russell M Davies,**

**Oliver Franklin-Wallis, Ben Hammersley,**

**Chris Haslam, Adam Higginbotham,**

**Roger Highfield, Nicole Kobie,**

**João Medeiros, Kathryn Nave,**

**KG Orphanides, Tom Vanderbilt**

Publishing director **Nick Sargent**

Group head of revenue, digital and brand partnerships **Rachel Reidy**

Associate director **Silvia Weindling**

Senior partnerships director

**Sam O'Shaughnessy**

Associate director, partnerships

**Jessica Holden**

Partnerships executive **Amelia Morley**

Partnerships art editor **Jeffrey Lee**

Partnerships designer **Duarte Soares**

Senior project manager **Fiona Hill**

Senior project manager

**Amma Greenstreet**

Project manager **Sian Bourke**

Business manager **Jake Pummintr**



Director of editorial administration and rights **Harriet Wilson**

Editorial business manager

**Henry McNamara**

Human resources director

**Hazel McIntyre**

Head of finance

**Daisy Tam**

Chief operating officer

**Sabine Vandenbroucke**

Managing director **Albert Read**

**Please contact our editorial team via the following email addresses:**

Reader feedback: [rants@wired.co.uk](mailto:rants@wired.co.uk)

General editorial enquiries and requests for contributors' guidelines: [editorial@wired.co.uk](mailto:editorial@wired.co.uk)

**Press releases to this address only please:**  
[pr@wired.co.uk](mailto:pr@wired.co.uk)

Advertising enquiries:  
**020 7499 9080**

Chief digital officer **Simon Gresham Jones**  
Digital commercial director **Malcolm Attwells**  
Digital operations director **Helen Placito**  
Senior data manager **Tim Westcott**  
Marketing manager **Ella Simpson**  
Group property director **Fiona Forsyth**  
Communications director **Emily Hallie**  
PR manager **Sophie Mitchell**  
Social media and publicity executive **Sophie McKeesick**  
Circulation director **Richard Kingerlee**  
Newstrade marketing manager

**Olivia Streatfield**  
Subscriptions director **Patrick Foilleret**  
Direct marketing and events manager **Lucy Rogers-Coltman**  
Direct marketing and events manager **Brittany Mills**  
Assistant marketing and promotions manager **Claudia Long**  
Creative design manager **Anthea Denning**

Production director **Sarah Jenson**  
Commercial production manager **Xenia Dilnot**  
Acting production controller **Skye Meelboom**  
Senior production co-ordinator **Katie McGuinness**  
Commercial, paper & display production controller **Martin MacMillan**

**WIRED Consulting**

Managing director **Catherine Crump**

Senior client development manager **Jon White**

Senior project consultant **Emma Cowdray**

Junior project consultant **Eliza Chereau**

Junior project consultant **Lily Griffey Hill**

**For enquiries: [consulting@wired.co.uk](mailto:consulting@wired.co.uk)**

**WIRED Events**

Head of strategy and experience **Kim Vigilia**

Sponsorship director **Christopher Warren**

Client account delivery manager **Ellen Garlick**

Events marketing manager **Jessica Taylor**

Events and marketing co-ordinator **Annie McGill**

**For enquiries: [wiredevents@condenast.co.uk](mailto:wiredevents@condenast.co.uk)**  
**[wired.co.uk/events](http://wired.co.uk/events)**

Regional sales director **Karen Allgood**

Regional account director **Heather Mitchell**

Head of Paris office (France) **Helena Kawalec**

Italian/Swiss office **Angelo Careddu**

Associate publisher (US)

**ShannonTolarTchkotoua**

Account manager (US) **Keryn Howarth**

Classified director **Shelagh Crofts**

Classified advertisement manager

**Emma Alessi**

Acting classified advertisement manager

**Casey Drabble**

**WIRED**

The Condé Nast Publications Ltd  
Vogue House,  
1-2 Hanover Square  
London W1S 1JU



# A110 COLOR EDITION

ONLY AVAILABLE IN  
2020



HISTORIC PAINT COLOUR  
"JAUNE TOURNESOL"  
AVAILABLE EXCLUSIVELY  
TO ORDER IN 2020.



TRANSMISSION:  
DUAL CLUTCH,  
7 SPEED  
AUTOMATIC



18" GT RACE  
BLACK ALLOY WHEELS, MATT FINISH

ANTHRACITE  
BRAKE CALIPERS

FRONT  
HEADLAMPS  
WITH BLACK  
INSERTS



320  
MAXIMUM TORQUE

Official fuel consumption in mpg (l/100km) and CO<sub>2</sub> emissions (g/km) for the Alpine A110 Color Edition 2020 are: Combined 38.7 (7.2) and CO<sub>2</sub> 163 g/km. Official fuel consumption in mpg (l/100km) and CO<sub>2</sub> emissions (g/km) for the Alpine A110 range are: Combined 39.2 (7.2) - 38.7 (7.2) and CO<sub>2</sub> 162-163 g/km. WLTP figures shown are for comparability purposes. Actual real world driving results may vary depending on factors such as weather conditions, driving styles, vehicle load or any accessories fitted after registration. From April 2020 the WLTP test cycle which will be used to calculate vehicle tax on first registration. For more information, please see [alpinecars.com/en/wltp/](http://alpinecars.com/en/wltp/)



01

SABELT® BUCKET SEATS IN LEATHER  
AND DINAMICA WITH AN EMBROIDERED  
YELLOW ALPINE LOGO

ROOF LINING, SUN VISORS  
AND WINDSCREEN PILLARS IN  
BLACK DINAMICA

ALPINECARS.COM



ALPINE  
Smile Machines since 1955



**ADAMA JALLOH**

Jalloh photographed Gift Ajimokun, a diversity and inclusion consultant, to open the Work Smarter section. “Gift is passionate and confident, and I wanted to convey all that with just a look,” she says. “I like to bounce between showing aspects like power and playfulness.”

**SHAMIL TANNA**

Tanna photographs Richard Browning this issue – the real-life Iron Man who flies using a jet suit. “I tried to make him look like a super hero,” he says. “The tech on the suit still looks kind of home made, so while I’d like to try it one day, I’m not quite ready to strap a jet engine to my arm.”

**JUMI AKINFENWA**

Akinfenwa writes about the burden being placed on Black employees to “fix” their workplaces. “There are definitely those who feel the pressure to take on this extra burden,” she says. “But managers need to view D&I as a long-term investment, and not a one-off workshop run by a staff member.”



Above: Jonathan Minster’s dreamlike image of a brain, which looks nicer than it smelled

PHOTOGRAPHY: JONATHAN MINSTER; JEROME NG.  
ILLUSTRATION: MATTHEW GREEN

## Creating WIRED

**WE BUILT THIS CITY...**

Cities around the world are reinventing urban living – so we asked illustrator Jerome Ng to encapsulate this transformation for our future cities feature: “I wanted to convey a place I would want to live – green, sustainable, pedestrianised. I created a 3D model of my dream city, and then added the details like buildings and shops by hand, without using a ruler – there are no straight lines in the real world, so even my ideal metropolis is a bit wonky.”

### BEAUTY AND BRAINS

This issue’s feature on the work of neuroscientist Sarah Garfinkel, which posits a bio-neural feedback link between the heart and brain, called for some potentially gory still-life images from photographer Jonathan Minster: “I have a friendly butcher who has helped me out in the past in selecting photogenic bits of animals for shoots, and he hooked me up with a nice heart and some brains. My initial shots looked a bit Gothic and vampire-y, so I decided to make them feel more ethereal – the parts were shot under a sheet of glass, and smoke was blown into the gap, which creates a sort of hazy, dreamlike effect, and stops the meatiness looking quite so... meaty. The brains arrived on a tray, and wobbled like a jelly. You had to be careful not to handle them too much, because after a while they’d sort of deflate. The smell under the hot lights was the worst part of working with them – I had to nip to the shops to buy some joss sticks...”





# LSX

GIVE YOUR MUSIC THE SPACE IT DESERVES



## True Stereo Wireless Music System

Two speakers have always been better than one. That's why we developed the dynamic LSX, a fully wireless stereo system. 50 years of KEF acoustic innovation with all the convenience and connectivity of wireless. Unleash your music and give it the space to dance around the room. Don't just hear music, feel it.

Design by Michael Young | Fabric by Kvadrat



AirPlay 2 | Spotify Connect | TIDAL | Qplay | Roon | Bluetooth

KEF.COM





**Back in March, when office workers** began the strange, unexpected remote working experiment, there was gnashing of teeth and wailing from some executives – how could workers be industrious if they weren't clocking in and out of a physical space five days a week? Surely the allure of Netflix and establishing a kitchen garden on a tiny balcony in a three-person flat share would sideline their sales calls? A parent home schooling a child could not be expected to file those all-important TPS reports?

But there was another type of manager: one that supported their team and devolved responsibility to those working on the front line of the



## Build resilience by trusting more

business. As the days turned into weeks and months, what became clear was that the data – for instance, a Stanford study showing an uptick of 13 per cent in productivity in some tasks – demonstrated otherwise: far from avoiding work, employees found that, in unpredictable times, their job offered them not only income but purpose, an anchor against tides that could untether them. With the support of communicative managers, deals were finalised, targets realised and teams developed cultures and behaviours that resulted in new types of products and innovative thinking.

It's crucial to remember that the rise in remote work would not have been possible without the millions of people who can't commute virtually and have provided the rest of us with the ability to conduct our lives in relative safety. For those of us working at our kitchen tables, while global economic forecasts

were grim and we dug in for the long haul, there was an energy and tenacity about many organisations. Financial forecasts were being redrawn, but the idea of organisational collapse due to employee inattention had been greatly exaggerated. Some industries were (and are) suffering terribly, notably retail, but others, particularly the tech industry, demonstrated vigour and robustness.

Professions such as legal services and primary care medicine – which for years had idly played footsie with the idea of becoming digital-first – moved the vast majority of their endeavours online. One prominent energy startup established phone lines for its vulnerable and elderly customers over a weekend.

Organisations are currently planning for 2021 and beyond with wholesale changes in their strategic thinking. New assumptions, values and expectations are being factored into businesses

across the spectrum. One of these should be a new relationship with organisational trust that acts as the sinew that makes organisations stronger.

Hierarchical management configurations were already being replaced by structures that devolved responsibility to teams that were judged not on the basis of how long they sat at their monitors each day, but how they could work together to produce results. The rise of trust within business could be the most lasting and impactful trend to emerge from the Covid-19 era.

The organisations that will emerge stronger from this crisis are those that assume best intent and have the conviction to believe in their workforces. As teams return to physical locations, managers that double down on the experience of homeworking during Covid-19 and construct working cultures rooted in interdependence underpinned by trust will find that not only will they attract the strongest talent, but their teams will be better placed to respond to whatever challenges come next.



Greg Williams  
Editor

ILLUSTRATION: GREGORI SAAVEDRA



# The typical environmentalist.

Join the recharging revolution.

## Care more

Replaces thousands of single-use batteries.

## Save more

Lasts for up to 500 charges.

## Do more

7x more power.\*

Being an environmentalist just became a lot easier with GP ReCyko rechargeable batteries. You'll put a lot less stress on the environment. And on your wallet.

**Rethink. Recharge. ReCyko.**

**GP** ReCyko  
RECHARGEABLE



\*vs GP Super Alkaline batteries in digital cameras



EDITED BY AMIT KATWALA & GIAN VOLPICELLI

START



7

The realistic head  
sits over your  
home assistant to  
stop it listening in

THE ECHO





# CHAMBER

Artist May Safwat's project uses the likeness of whistleblower Edward Snowden, and he's not just a pretty face – her facsimile can stop your home assistant from snooping...



# T

he hardest thing about creating a scale model of Edward Snowden's head is getting the glasses right. This is Echo Chamber – a copper-lined life-size replica of the NSA whistleblower's head. It sits over a home voice assistant, such as an Amazon Echo, and blocks it from hearing you and connecting to the internet.

May Safwat – an artist and filmmaker, and a lecturer at the Kingston School of Art – came up with the idea after having conversations with friends and family members who were convinced their smart speakers were listening to them, even if they hadn't said one of the wake words (like "Alexa" or "OK, Google"). She had the idea of creating a physical object that could give a sense of control: Edward Snowden was the obvious choice.

"I see him as the patron saint of privacy," she says. In 2013, Snowden famously leaked thousands of documents which revealed the extent of state surveillance by the NSA and other security bodies – an action that forced him into exile. "You know you're safe, because Snowden's got your back." But, since then – and despite his warnings – we've embraced smart devices which listen in and track us.

Safwat – who says she's not necessarily anti-Amazon, but wants to spark a conversation – created a 3D render of Snowden's head based on publicly available imagery, and worked with a special effects company to create the bust. For full accuracy, she needed a pair of glasses with the same level of refraction as his actual lenses, which involved some very strange visits to the opticians at the height of lockdown, with the head in tow.

"Snowden did not want the conversation to be about him, but in this piece, he is an emblem reminding us of our tenuous privacy," says Arvind Narayanan, a professor of computer science at Princeton University. "Snowden is also apt because the line between commercial and state surveillance is blurry. The NSA's mass surveillance is only possible because it piggybacks on tracking networks that tech companies have built, and which we have invited into our homes." **AK**



## WE CAN ALL SAY IT WITH FEELING

Emojis are an essential aspect of modern communication – now designers are making them more inclusive, so everyone gets heard

**At first, the problem seemed small.** The "woman facepalming" emoji sent from Android devices was showing up as a man on Apple devices. This can happen when two tech vendors interpret the same emoji differently. For instance, when Apple changed its pistol emoji to a water gun in 2016, other vendors followed suit, presumably to avoid a scenario where one friend texts "excited for the beach 🏊" and the other receives a darker "excited for the beach 🏊".

But, after a complete audit was done of all emojis with gender signifiers, it became clear the issues ran deeper than just miscommunication. Stereotypes abounded. Doctors, police and rock climbers were all men, for example, while emojis of people being sassy or getting a haircut were always women.

A series of articles and proposals were published, demonstrating the pervasiveness of the issue. In response, technology companies like Google, Apple, and Facebook began to ensure all their emojis came in male and female versions.

Paul Hunt, a designer at Adobe, didn't think this solved the problem. Hunt is a member of the Emoji Subcommittee at Unicode, the organisation which approves all new emoji and oversees the symbols across tech companies to ensure cross-compatibility. "The original Unicode guidance stated that depictions of emoji should be gender neutral," Hunt says.

Emoji creation requires condensing worlds of meaning into a tiny, immediately legible image that will communicate across many cultures. Hunt wanted to create characters which could communicate outside the binary genders. In 2016, he proposed the first set of gender-inclusive emoji designs.

Ultimately, Hunt found that when working with such a small image, hair became the most significant gender identifier. His women had longer hair, his men short hair, and his gender-inclusive emojis sported wavy hair that flared just below the ears. In 2017, his proposals for gender-inclusive emojis of adult, baby and older person were accepted, and they prompted designers to push forward and consider how to create characters outside the binary, moving away from realistic emojis to more abstract and symbolic ones.





“It isn’t meant to be a non-binary character,” says Jennifer Daniel, head of emoji design at Google and chair of the Emoji Subcommittee at Unicode, “but just the concept of farmer, or the concept of doctor, so you don’t have to have gender baked into those roles and professions unless you want to.”

In 2019, a new major emoji release added gender-inclusive options for all professions, fantastical creatures, sports players and all other human-depicting emojis, with the exclusion of seven emojis that retained gender-specific expressions, such as a pregnant woman and a woman in headscarf.

Suddenly, we had three gender options for zombies, royal guards, detectives and many other emojis that seemed barely distinguishable from one another. Hair length proved to be a critical gender signifier at Google too, and the emoji design team there used the colour orange for all their gender-inclusive renderings, so they would be immediately recog-

nisable. This included the orange tank top of the gender non-specific yoga emoji, as well as the orange tail of the merperson, who, unlike the mermaid with her seashell bra or the merman with his smooth torso, has arms crossed against their chest.

Other companies handled this differently: Apple used grey for most of its gender-inclusive characters, and gave its merperson a tank top instead of crossed arms. The goal in all designs was to remove markers that would signify a particular gender association – at Google, the gender-inclusive vampire emoji, as well as the office worker, for example, were freed from their collared shirts.

“The concept of male and female don’t stand still, and yet we’ve all collectively agreed that a person with a skirt means woman when you walk into the bathroom. Women don’t all wear skirts, but we understand that as an abstract concept,” says Daniel. “So what we wanted was an abstract concept to create this character that existed between the binaries.”

Not all users agree with the direction of this design strategy, which is focused on removing overt gender markers, and often relies on typically Caucasian

# Suddenly, we had three gender options for zombies, royal guards and detectives

features, like straight hair. Os Keyes, a PhD candidate at the University of Washington who studies gender, power and technology, describes the current designs as little more than “a feminine person in a suit.”

“Most stuff that is gendered is gendered feminine because stuff is male by default,” Keyes says, adding that this often results in intentionally androgynous characters being rendered as more feminine-featured, a result evident in the gender-inclusive emojis.

As our emoji options expand alongside expressions of gender fluidity, emoji designers will have to keep up with how their designs are used. “The more detail there is, the harder it is to identify with it, because those details are to the exclusion of other details,” says Daniel. “When you include one thing, you exclude something else.” Shira Telushkin

## From idea to iPhone Tips for submitting an emoji proposal to Unicode

1	2	3
<b>CITE YOUR SOURCES</b> Explain why your emoji is needed. Previous successful proposals have cited Taylor Swift’s “Bad Blood”, Eurovision winner Conchita Wurst and William Shakespeare – the more original and fresh, the better.	<b>KNOW YOUR AUDIENCE</b> <b>Show there’s a demand that your emoji will be used – from Google search results, social media or articles clamouring for its inclusion. The proposal for the “what do you want” fingers-pressed-against-thumb emoji spends six pages on the significance of the gesture in Italian culture, for example.</b>	<b>FOLLOW THE RULES</b> There are six factors that can block your emoji. Your proposal must show the idea is not overly specific; open-ended; already represented; affiliated with a logo, brand, user icon, specific person or deity; transient (so no fads); or primarily a variation on an existing emoji.



ILLUSTRATION: RAMÍ NIEM



# ARTIFICIAL INTELLIGENCE CAN ENSURE BEAUTY IS FOR EVERYBODY

Atima Lui is using AI to bring the full spectrum of skin tones to the makeup counter – and her tech could make inclusivity the default



➤ Atima Lui's Nudemeter is a computer vision tool that can accurately match skintone to a suitable product



# A

**tima Lui was in primary school when** she first learned that “nude” is not universal. Now 30, she still recalls playing with a white friend’s makeup and struggling to find colours that complemented her rich skin tone. “I would try to put [her makeup] on and it would just make me look like a clown,” says Lui, who is of Sudanese and African-American descent. “I think back to how my mother barely wore makeup. Now I know it’s because makeup just wasn’t made for her.”

The cosmetics landscape has long been unfriendly terrain for anyone on the wrong side of beige. Before Rihanna introduced her ground breaking Fenty Beauty line with 40 shades of foundation in 2017, pushing competing brands to diversify their palettes, people with darker skin had few accessible options that matched and enhanced their complexion.

What Rihanna has done to address the issue of foundation shade selection, Lui hopes to do for colour matching – finding the perfect shade of makeup is usually left to guesswork or performed by associates on the beauty department floor. With her computer vision tool, Nudemeter, users simply upload a selfie and complete a short quiz, and an algorithm suggests the product that best matches their skin tone.

Lui had the idea in 2016, during her final year at Harvard Business School, as a tool to empower dark-skinned shoppers. “I just went back to being a Black woman growing up in Topeka, Kansas, and just not feeling beautiful, not feeling like the standard of intelligence, not feeling good enough,” she explains. “Beauty is undervalued as a source of power in the world.”

But the world of facial recognition technology is as guilty of light-skin bias as the beauty industry. A 2018 MIT study, led by Algorithmic Justice League founder Joy Buolamwini, found that commercial AI systems had error rates as high as 35 per cent when identifying the features of darker-skinned women, compared to less than one per cent for lighter-skinned men

- a discrepancy attributed to datasets “overwhelmingly composed of lighter-skinned subjects.”

To avoid this problem, Lui had to train her algorithm with skin-colour images from the palest whites to the darkest browns. To this end, she issued call-outs for volunteers of all skin tones to submit photos of themselves to aid in her mission to “change the standard of beauty to match the full range of diversity in human skin.” Once she had a dataset in place, she reached out to Michael Brown and Mahmoud Afifi at York University in Toronto, who specialise in colour analysis and digital image processing, to make sure the algorithm could deduce the user’s true skin tone, regardless of their device or the conditions in which their photo was taken.

“[Our phones] are really intended to create beautiful images, not images with colour accurate measurements” Lui says. “It’s all about using AI to predict the colour of the real scene that is depicted in the image, and not the colour from the pixels.”

The potential for this technology hasn't gone unnoticed. In 2018, beauty behemoth Coty, whose brands include Rimmel, Max Factor and Kylie Cosmetics, awarded Nudemeter the grand prize for their Digital Accelerator Start-Up Program, and helped Lui refine and stress test her algorithm. Last year, Spktrm Beauty, an independent brand targeting shoppers with darker skin, became the first to utilise Nudemeter on its website, and in May, hosiery company Nude Barre introduced the app to help shoppers pick out the right tights for them.

**'It's about feeling seen,  
feeling beautiful and  
having fun... but this work  
of creating inclusive  
technology is never done'**

Lui hopes to see further growth on the colour-matching side, but also sees potential beyond that. “I think there’s power in using it for opportunities like virtual makeup or glasses try-on, or even improving Instagram filters,” she says. “It’s about feeling seen, feeling beautiful and having fun.”

She also envisions someday sharing her proprietary dataset with other companies attempting to create more inclusive AI technologies and combat existing biases. But in the meantime, her priority is refining and challenging the Nudemeter algorithm.

"I'm really proud of how well my technology can measure the skin tones, undertones and differences of dark-skinned women... But how is the technology reading the faces of people with vitiligo? What about people who have hair loss, or have a lot of wrinkles?" she says. "This work of creating inclusive and representative technology is never done." **Allyssia Alleyne**

## MessageBird: the end of hopeless helplines

## In a wfh world, the options

for communicating with our friends and family are staggering: you can Zoom, WhatsApp, ping on Facebook, or – you know – just call them. Dealing with companies, however, is a different story: you either use their own apps – think Uber or Deliveroo – or brace yourself for sluggish emails, ricocheting calls and listless texts. MessageBird, a Y Combinator veteran, wants to change that. The Amsterdam-based company aims to make customer service less frustrating, and to do so it has developed a free platform (with some premium features) that allows customers and brands to interact via voice or text over every popular channel – voice, SMS, WhatsApp, LINE, Messenger, Viber, WeChat, Telegram and even Instagram. “Our vision is for businesses to talk to their customers like they would talk to their friends,” says company founder and CEO Robert Vis. MessageBird’s tech also harnesses AI to spot what customers are complaining about, and link them to the best person to help them. Just after the new product’s launch in March 2020, the Covid-19 pandemic started wreaking havoc – so MessageBird made the platform free and unlimited for hospitals and governments.

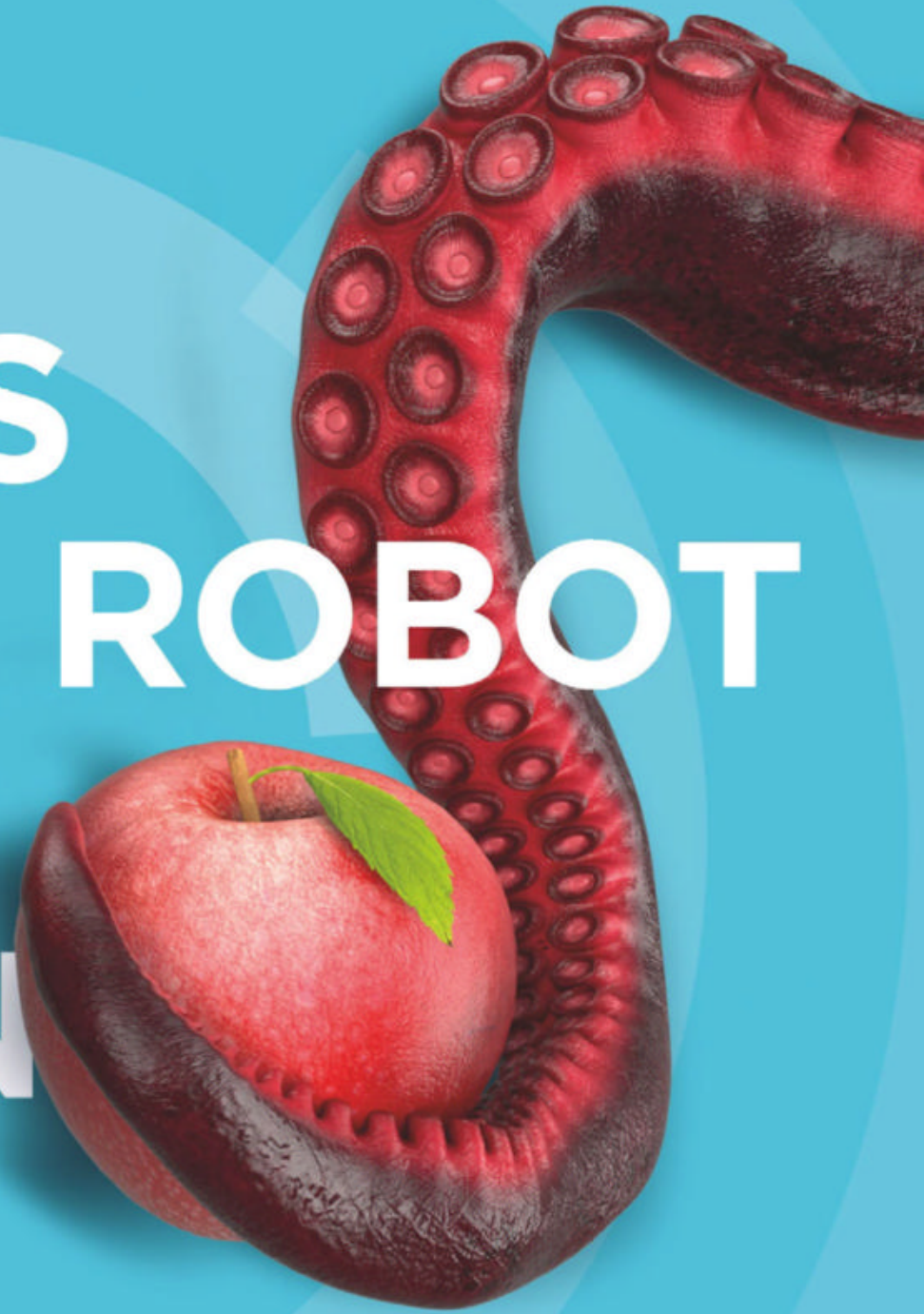
**GV** [messagebird.com](https://messagebird.com)







# CAN AN OCTOPUS TEACH A ROBOT HOW TO HOLD AN APPLE?



Ingenuity demands a different perspective, seeking inspiration in surprising places. At PA, we combine innovative thinking with breakthrough technology to create a positive human future in a technology-driven world.

**Bringing Ingenuity to Life**  
[paconsulting.com](http://paconsulting.com)



As the EU Commissioner for its internal market, Thierry Breton is in charge of writing digital policy to rein in the technology giants, from search to social – and because he’s a former insider, they actually listen

## KEEPING TECH FIRMS IN LINE BY SPEAKING THEIR LANGUAGE



Thierry Breton,  
photographed  
by WIRED in July  
2020, in Paris

**Thierry Breton’s career could not be more different from** a typical Eurocrat’s. The French commissioner responsible for the European Union’s internal market and shaping its digital policy describes himself as an engineer, a scientist, an economist, an entrepreneur, a professor, a CEO – and a politician. Over the course of his career, he has launched a software-engineering startup, led major tech and telecom companies such as Thomson, Atos, and France Telecom, acted as France’s economy and finance minister, and taught global governance at Harvard.

In the 1980s, Breton also had some success as a writer of science-fiction novels – in which he (rather presciently) envisioned a world run by technology billionaires where

computer viruses and fake news threatened the global world order. As a young entrepreneur selling software in New York at that time, Breton had trouble convincing computer scientists of the importance of protecting systems from malicious intrusions.

“They said I was exaggerating,” Breton says when WIRED meets him at the European Commission offices in Paris. Breton decided to change the minds of their bosses, the CEOs. He started writing a thriller to “use a popular style that interests them and would allow myself precisely to disseminate my ideas and thus my company.” The resulting co-written novel, *Softwar*, became a best-seller in France and was translated into a dozen languages.



Breton no longer needs to find unusual ways to convince technology leaders: he just picks up the phone and calls them. During the Covid-19 lockdown, he asked Netflix CEO Reed Hastings to lower the definition of videos on his platform to prevent European networks from being overwhelmed – “I just asked him to help me out”. Then there was the time when he told Facebook’s CEO to tackle disinformation on the platform: “Mark, everything that is not forbidden by law in the informational space is not necessarily authorized, think about it.” In a public video-conference in May, Breton laid into Zuckerberg, urging him to “pay taxes”.

Breton believes tech CEOs will do as he asks. “I know this world. I come from it. I know the actors,” he says. “I am asking

That is no mean feat in these volatile times of pandemic and geopolitical stand-offs. The US and China are stuck in a confrontation that often revolves on technological matters – from 5G to social media – forcing the European Union to think seriously about achieving its own technological autonomy. “We see a continuity in a pre-existing EU digital policy, but with new rhetorical elements – like a clearer affirmation of Europe’s place in the world and of its liberty to determine its own digital path,” says Nocetti. The novel coronavirus crisis has compounded that urge, highlighting the EU’s need to be less reliant on foreign supply chains and companies.

But to accomplish that, Europe and its tech sector will need to scale up. Up until now, the EU Commission’s chief forays into technology have amounted to regulation and high-profile fines. That is changing: according to Isabel Skierka, a data and technology fellow at the Global Public Policy Institute, the commission is focusing on encouraging innovation in order to “build a European digital ecosystem”, able to hold its own compared to the US. Since he joined the commission in December 2019, Breton has already unveiled plans to attain that, including the EU’s digital and industrial strategies and an AI and data roadmap.

“The EU has long had the image of regulator, and maybe of over-regulator,” Breton says. “We will make sure that European entrepreneurs can blossom.”

His hardest battle might be within the Commission itself, says Johan Bjerkem, an analyst at the European Policy Centre in Brussels. Breton’s digital portfolio overlaps with EU executive vice-president and antitrust supremo Margrethe Vestager, who has both more powers than Breton and a different style – she is the one who has repeatedly slapped American tech titans with eye-watering fines.

“Vestager is much more focused on the need to have fair competition across Europe,” Bjerkem says. “For Breton, it’s much more important to boost the European tech industry.” **Clothilde Goujard**



**Breton’s guide to getting his way**

**SCARE CEOs**  
Struggling to get US CEOs to take computer security seriously, Breton co-authored a book, *Softwar*, that laid out his concerns in its terrifying plot.

**BE A CEO**  
A former CEO of France Télécom, Breton has cultivated a valuable network of relationships in the business and technology world.

**SHAME CEOs**  
In May 2020, during a public video-call with Mark Zuckerberg, Breton laid into the Facebook CEO, entreating him to “pay taxes”.

# ‘I tell the tech CEOs that if they want to keep doing business in the EU, it’s up to them to adapt, not me’

them to do things that are feasible. I tell them that if they want to keep doing business in the EU, it’s up to them to adapt, not me.”

Observers agree that one of Breton’s greatest strengths as a commissioner is his network of contacts in business, coupled with a notable technology and business acumen. “He’s an insider, unlike previous commissioners in his position,” said Julien Nocetti, digital policy expert and teaching fellow at France’s St-Cyr military academy. “It is fairly positive for the EU Commission to have someone like him – it’s a strong political signal.”

Breton has developed his approach to policy-making by building on his experience in both the private sector and government. He thinks management and public action need to anticipate rather than follow regulation, thus encouraging actors to modify their behaviour. In his teaching days at Harvard, he called this method “soft law”.

“If you tell [companies] ‘change your behaviour a little’ and they say yes, they’ll do it in 24 hours” he explains. “I’m gaining time and we can obtain results through constructive dialogue.”

On the other hand, Breton says he and the commission are ready to regulate and use “extremely strict” measures – from fines all the way to company break-ups, if tech CEOs do not adapt to European requests and standards. “We are clear about what we need and they’d better anticipate before law is put into place.”

Faced with the unbridled growing power and influence of Google, Apple, Facebook and Amazon, the commission, which initiates the laws for the European Union, has been trying to establish rules to keep their actions under check. Breton is particularly concerned about the spread of disinformation and hate speech. He likes to call the internet the “informational space”, one of the four spaces making up our geopolitical reality – together with land, sea and air. The first three have been regulated over the centuries via laws, taxes and registers; now Breton wants to bring order to the fourth.

WIRED	TIRED	EXPIRED
Product diversification	Hostile takeover	Friendly merger
Bluffets	Buffets	Sharing platters
Microchipped pig brain	Revived pig brain	Fried pig brain
Triller	TikTok	YouTube
SPAC	ICO	IPO



Where the inspirational go to be inspired. Hear top-level talks from a curated selection of scientists, artists, innovators, disruptors and influencers, and navigate through a responsibly scaled Test Lab.



WIRED Live will retain the rare combination of WIRED's journalistic eye, diverse programming and connections with innovators, designers, strategists and entrepreneurs – all designed to respect social distant requirements and personal comfort levels.

Virtual and in  
London, UK

This hybrid conference will explore some of the most fascinating innovation, design, ideas, business and technology changing our world and the way we live.

**WIRED**  
**Live.**

November 24,  
2020

[wired.uk/wired-live](https://wired.uk/wired-live)

Save 10% off when you book with discount code MAG10







# THE ISS: 20 IN 2020

The manned space laboratory finally gets ready for its close-up – just in time for decommissioning

On the International Space Station, it can be hard to keep track of time. The Sun rises and sets 16 times every 24 hours, and the clocks are permanently set to Greenwich Mean Time. But, no matter how you measure it, November 2, 2020, will be a very important milestone for the ISS – this date marks 20 years of continuous human habitation in space.

In *Interior Space*, a new book released to mark the occasion, Chicago-based photographer Roland Miller and Italian astronaut Paolo Nespoli – who spent 313 days in space – have worked together to photograph the interior of the long-serving space station in detail for the first time.

It's intended as an historical artefact as much as anything – as the ISS is due to be abandoned in 2024, and will be destroyed by 2028. “*Interior Space* will remain as a record when the ISS – one of the most technologically advanced and important scientific tools of the 21st century – no longer exists,” writes Miller. *AK Interior Space: A Visual Exploration of the International Space Station* by Paolo Nespoli and Roland Miller is published by Damiani, £45 [damianeditore.com](http://damianeditore.com)

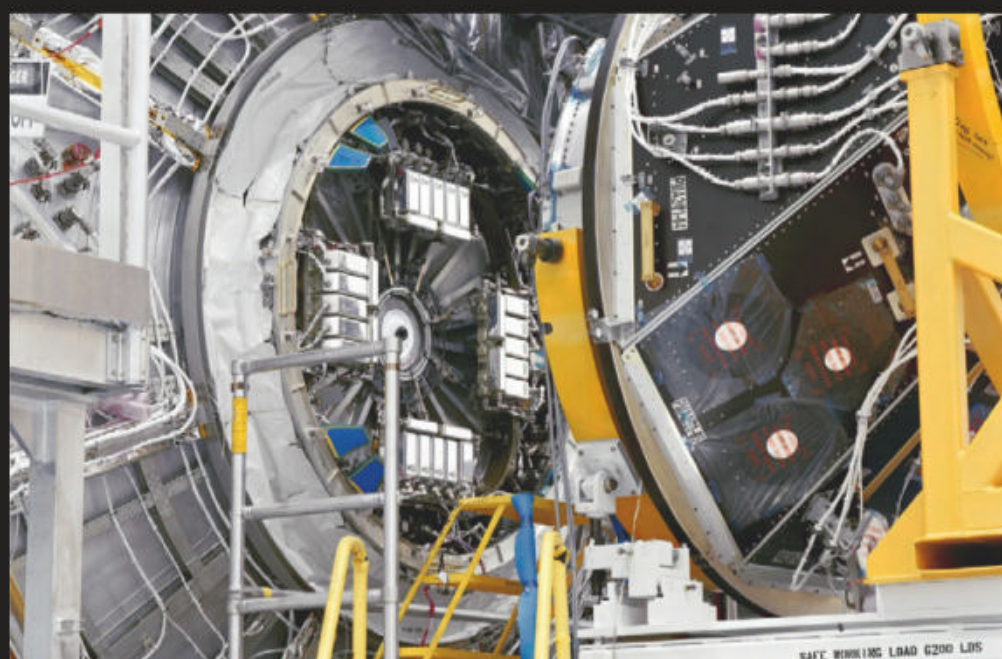
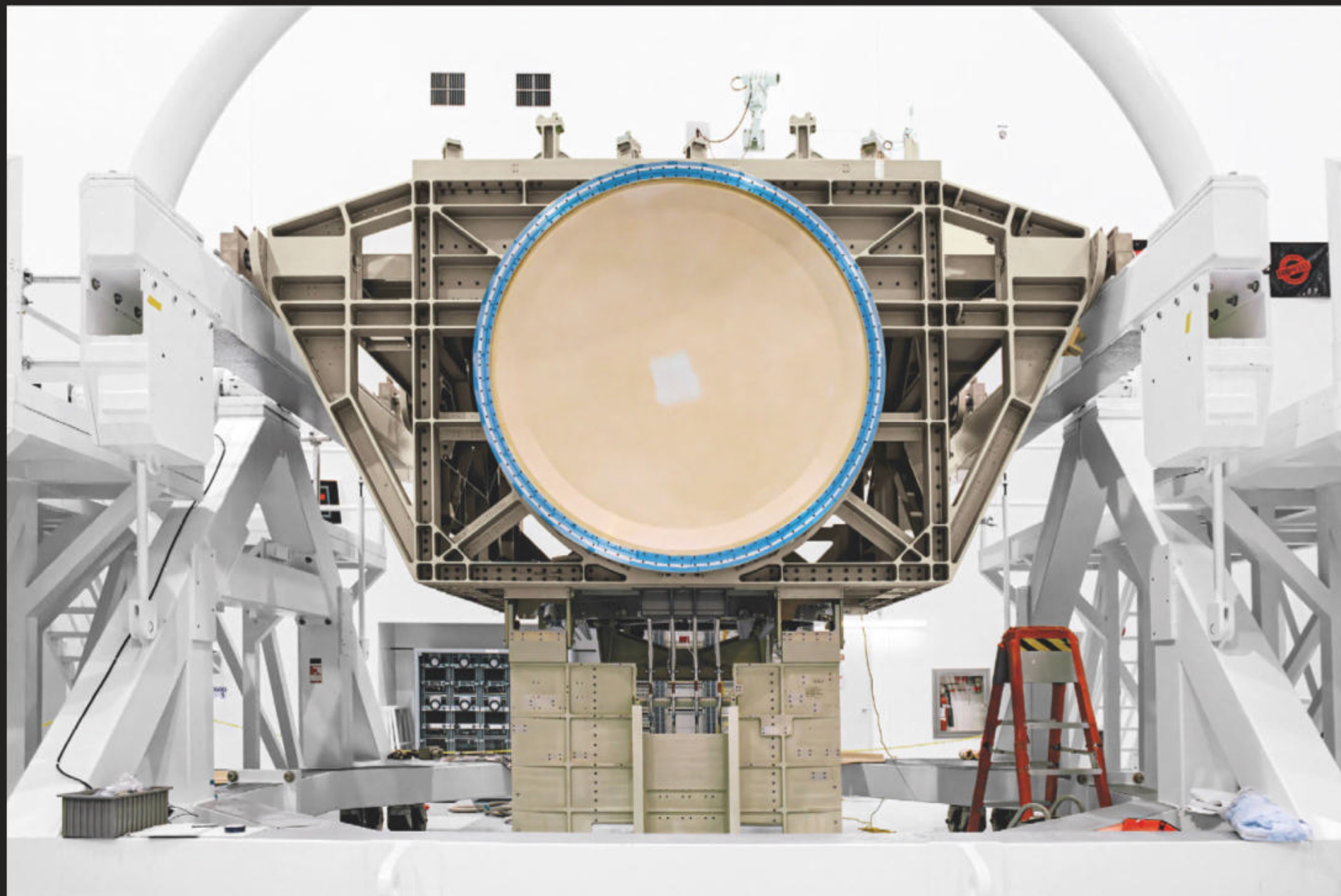




PREVIOUS SPREAD Nespoli took pictures in his spare time while in orbit. Miller used the full-scale replica of the ISS at Nasa's Johnson Space Center in Houston to solve technical photographic challenges, such as how to stabilise a camera in zero gravity.



Back on Earth, Miller also took photographs of many of the components of the ISS at the Space Station Processing Facility in Florida, before they were sent to space. This is part of the Z1 truss, one of the first elements of the ISS to go into orbit in October 2000.

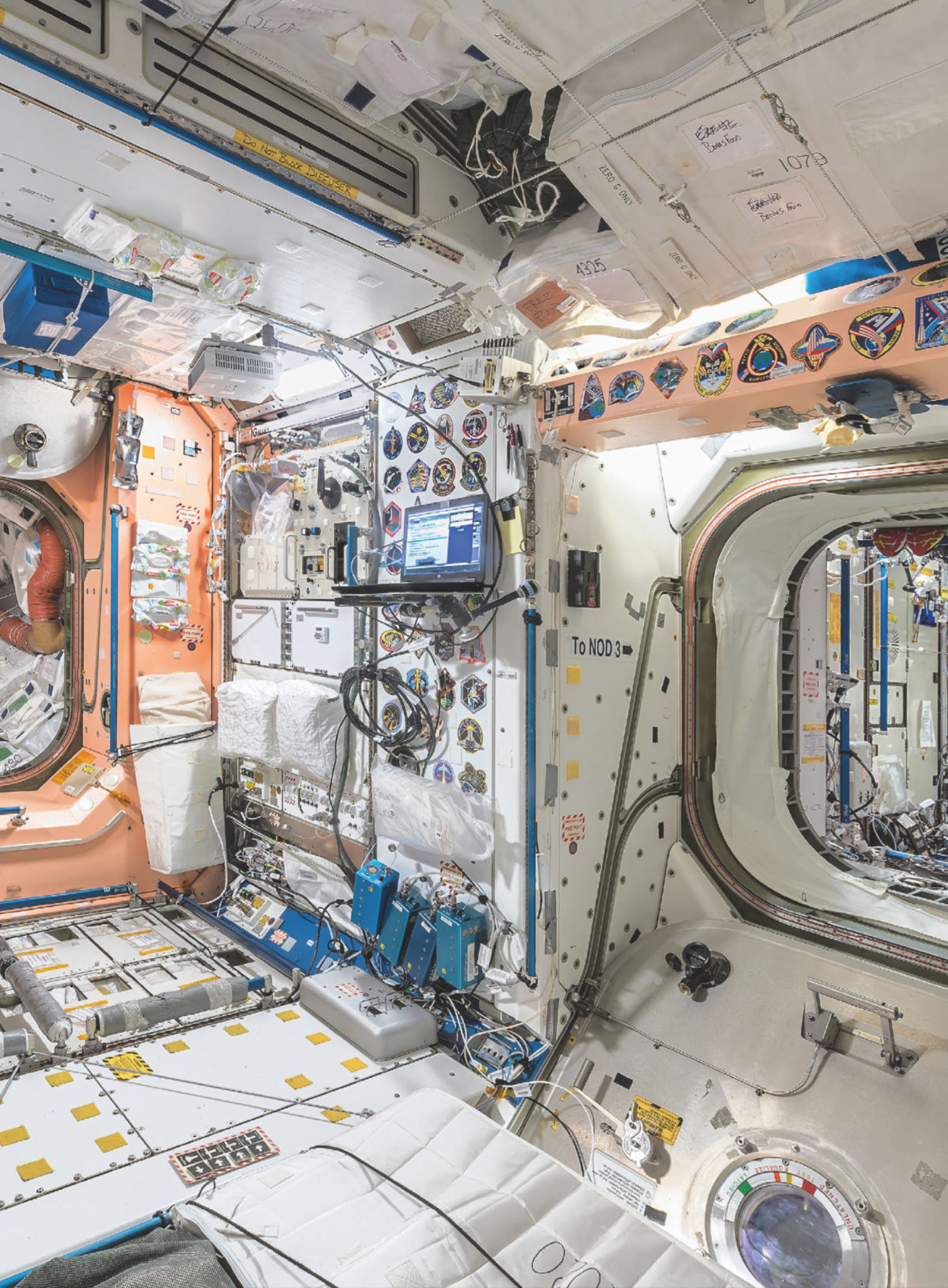


The ISS is modular, and it has been added to many times – it's now the same internal volume as a six-bedroom house. This picture shows an on-Earth test of the mating systems for Node 1, which connects the Russian and American segments.



In space, Nespoli used articulated arms attached to handrails to stabilise the camera in low gravity, and worked with Miller to find cameras resistant to cosmic radiation, which damages their light receptors. Most cameras on the ISS have to be replaced every year.







# THE SMALL TOWN THAT LEVELLED UP

W

ith 50,000 residents and pristine regency architecture, Leamington Spa seems like any other scenic countryside settlement. But this Midlands town, once a hotspot for Victorian aristocrats desperate to bathe in its healing waters, has become one of the UK’s video game industry biggest hubs.

AAA titles including *Far Cry*, *Little Big Planet* and *Forza* were all developed in a slice of rural Warwickshire known in the industry as “Silicon Spa”. One in every 50 people in Leamington works for a games developer, and the industry contributes over £100m to local GDP. So how did a small town in the Midlands become a miniature Silicon Valley?

“It’s like something out of a fairytale,” says Jordan Erica Webber, a games journalist and Leamington resident. “In the 80s there were two pairs of brothers, the Darling brothers and the Oliver twins, who made games in their bedrooms as teenagers and eventually started their own companies.”

In 1986, the Darlings founded Codemasters, which became one of the early pioneers in the UK gaming scene. The Olivers, who initially worked at Codemasters, would go on to set up Blitz Games. “These companies grew and grew and grew, and then at a certain point they started to splinter off and the people who left – having gained experience at Codemasters and Blitz – would form their own studios, and those studios would splinter and so on,” says Webber. That splintering is integral to a growing sector where smaller startup studios make up 99.5 per cent of UK games companies and generate the vast majority of the sector’s economic output.

But the reasons may go further than history. “The two local universities and Warwickshire College as well are all really important,” says Leamington’s Labour MP Matt Western. “They help create a fusion between various skill sets that the games industry needs, from sound engineers to physicists and historians. They help grow the industry.” And the industry is growing: it’s estimated 500 more jobs in game development will be created in the town in the next

## Silicon Spa walkthrough: tour the UK’s least-known tech hub

### 1 Rebellion Warwick

Founded in 2013 as Radiant Worlds Limited, it was acquired in 2018 by Rebellion.

### 2 Digital Sumo

The company behind *Little Big Planet* opened its Leamington Spa office in late 2019.

### 3 Well Played Games

This studio has tried every genre, from sandbox to card games, since it was founded in 2017.





START					
<b>4 + 9</b> <b>Playground Games</b>	<b>5</b> <b>Ubisoft</b>	<b>6</b> <b>Third Kind Games</b>	<b>7</b> <b>Pixel Toys</b>	<b>8</b> <b>HARDLight</b>	
Founded in 2010, it developed the <i>Forza Horizon</i> series. Bought by Microsoft in 2018.	The Midlands hub of this major games studio handles series including <i>Far Cry</i> .	Launched in 2016, this secondary studio assists AAA studios like Activision or Sony.	Running since 2012, it develops VR and mobile games for franchises such as <i>Warhammer 40K</i> .	Founded in 2012, it's owned by SEGA Europe, and manages all its mobile games.	
		<b>10</b> <b>Exient</b>	<b>11</b> <b>Unit 2 Games</b>	<b>12</b> <b>Kwalee</b>	<b>13</b> <b>Codemasters</b>
		Founded in 2000, it works on portable and mobile games, on big titles such as <i>Angry Birds</i> .	Since 2017 it has specialised in premier titles such as <i>Crayta</i> for the new Google Stadia.	Launched in 2011 by a Codemasters founder, it makes "hyper-casual mobile games".	Founded way back in 1986, it has developed huge racing titles such as <i>F1</i> and <i>Dirt</i> .



two years, and Mediatonic, the studio behind the *Gears of War* mobile game and *Fall Guys*, recently announced plans to open an outpost in Leamington.

The area is also home to Jaguar Land Rover, and the engineers and specialists working at its Gaydon hub has had a knock-on effect for the games industry. Local developers are famous for their racing games, like *Forza*, *Dirt* or *F1* – it's said the Silicon Spa specialises in making both cars and games about racing them.

"When we first moved here we were expecting San Francisco or something," says Shaun Wall, a local games developer. "But unless you know there's a gaming hub here you will not see anything about it on the street level. There's a sense that these big game studios all feel completely separate with their individual campuses all off in different places."

Wall started a group called Checkpoint with developer Maggie Tan to try and bring together the local gaming community, but both admit the often overlooked games industry doesn't exactly define the town. While that may be changing – the town is now home to a yearly gaming festival called Interactive Futures – you could be forgiven for missing Leamington's trademark industry.

But the presence of the industry certainly has indirectly shaped the area. "It brings in a diversity of both skills and nationalities and the entire town is enriched by that," says Western, who sits on the all-parliamentary group on video games. His 2017 election in this once solidly Conservative seat may reflect the changing demographics of the town, driven by the growing games industry.

Many hope the town can serve as a roadmap for a country with a tech sector increasingly centralised in London, which receives more investment and job opportunities in tech than the rest of the country put together. "If you've got a new industry as big and growing as game development, whose workers skew young, places like Leamington can really help decentralise the UK economy," Webber says. "That can only be good for the countless towns that have been negatively impacted by the concentration of industry around London." **Andrew Kersley**



Pangolins' unique appearance makes them a prized ingredient in traditional Chinese medicine – and has put them on the endangered list. Isoscape tracking could help to stop their slaughter at the source

## THE NEW ARMOUR IN PANGOLIN DEFENCE

**Before researchers suggested** pangolins may be a critical missing link in the transmission of coronavirus from bats to humans, most people had never really heard of them. Yet these scaly, ant-eating mammals are smuggled in huge numbers to Asia, and are in danger of extinction.

There are eight species of pangolin, split evenly between Africa and Asia, and each is barred from international trade. Identifying confiscated scales and body parts as “pangolin” can be enough to prosecute a criminal case, but discerning the species and tracing their geographic origins is tricky.

Wildlife forensics is a field that uses scientific procedures to investigate crimes against wildlife. To help crack down on intricate trafficking routes and poaching hotspots, scientists and lab technicians are figuring out ways to analyse the DNA and dietary history of seized animals and their products.

PHOTOGRAPHY: JULIEN FAURE





Most consumers come from mainland China and Vietnam, where pangolin meat is a delicacy and the scales are a popular ingredient in traditional Chinese medicine, touted as a cure for anything from asthma to cancer, and as an aid to help mothers with lactation.

Because the four Asian species have been hunted to near extinction, criminal networks are extending to Africa. In 2019 alone, authorities seized 81 tonnes of pangolin scales, with more than half of shipments coming from Nigeria. Traffickers frequently change their routes, however, which makes tracing a shipment's origins extremely difficult, according to a report by the wildlife trade monitoring group TRAFFIC.

Forensic techniques, such as DNA analysis and radiocarbon dating, as well as sniffer dogs, are already being used

Pangolins are thought to have passed the coronavirus to humans, after they first caught it from horseshoe bats

to tackle the illicit trade in timber, rhino horn and elephant ivory. The analysis of DNA can also help identify a pangolin species from confiscated scales. "Seizing tonnes of pangolin scales that arrive in Hong Kong or Kuala Lumpur is great, but you can only really prosecute people on the ground, and you don't know where these scales are coming from," says Rob Ogden, programme director at TRACE, an NGO that brings together forensic scientists and law enforcement agencies. For instance, the distribution of the ground pangolin *Smutsia temminckii* stretches from Southern Africa through East Africa and as far as Sudan and Chad.

To tackle this problem, researchers at the University of Hong Kong (HKU) are developing new ways to determine the origins of birds, turtles – and most

recently, pangolins – based on what they ate. Food sources have different ratios of stable isotopes, or atoms of the same element (e.g. oxygen, carbon and nitrogen) with slightly variable weights, that are stored in animal tissue. Water and soil also vary in their isotope ratios according to geography, which allows scientists to create an "isoscape" for regions or locations that can be matched with that found in scales.

Caroline Dingle, an evolutionary ecologist in HKU's conservation forensics lab, explains that stable isotope analysis could be used to study whether animals are predominantly poached in a single country and shipped directly to Hong Kong, or whether they are hunted across the African continent and consolidated in a transit hub like Nigeria. "That information can be used to help understand where you need to send enforcement," she says.

There is one major drawback, though. The isoscapes will vary across the range of a pangolin species, but unless forensic scientists have access to a database showing how they change between, say, South Africa and Sudan, it will be difficult to pin down where an animal was caught. Ecologists have started compiling these isoscapes by collecting water, soil and plant samples. "There's a huge amount of work to do to create an isoscape for any species found across such wide ranges as pangolins," says Ogden. **Sabrina Weiss**

Pangolin scales are a booming business in Asia thanks to their status as an ingredient in traditional Chinese medicine, while the animal's meat is considered a delicacy. These are just a few bags of scales from poached pangolins; in 2019, a massive 81 tonnes of scales were seized – and that is only the illegal shipments that were intercepted, so the real number is likely far higher. By finding out where these parts originated, conservation groups can focus resources on catching the traffickers.



**'Seizing tonnes of pangolin scales that arrive in Hong Kong is great, but you can only prosecute people on the ground, and you don't know where the scales are coming from'**



# SCIENCE'S SUPERHERO

When Marvel filmmakers need some smarts to save the day, they call British theoretical physicist Clifford Johnson

Clifford Johnson spends his days dissecting some of science's most inscrutable mysteries. How does quantum physics apply to our understanding of space and time? What is the true nature of black holes? What are the origins of the universe?

But, as the Marvel Cinematic Universe (MCU) ventures further into quantum realms, time travel and space exploration, Johnson has added to his daily musings. He's become the MCU's go-to guy when its producers need to sprinkle a little scientific realism into their superhero stories.

With credits on television shows and films from *Thor: Ragnarok* and *Avengers: Endgame* to the forthcoming *Ms. Marvel*, Johnson has helped shape some of the MCU's most memorable depictions of science and scientists in action. With *The Falcon and The Winter Soldier* due for release on Disney+ this autumn, we spoke to the Los Angeles-based advisor about getting science right in the biggest movie franchise of all time.

**Qualifications aside, how does one become Marvel's go-to science advisor?**

My involvement varies from project to project and I'm by no means the only scientist they have on speed dial. The US National Academy of Science set up The Science and Entertainment Exchange to try and get better representation of science and scientists in entertainment media, and I came to the MCU through them. Marvel has been extremely smart in how they try to represent science. I call it "Marvel science". It's obviously not *real* science, but it is definitely rooted in things from the real world.

**Does your involvement change from film to film?**

It varies. The first thing I do is read the script and make copious notes and suggestions on every bit that I can. Sometimes they just want some scientific buzzwords, and to know what certain things might look like. In *Thor: Ragnarok* I was brought in to advise on wormholes. I suggested that each wormhole has a different character and visuals depending on what kind of astrophysical object we find at its end.

**What's the biggest impact you've had on a story?**

It's fun when you get to work with the filmmakers from an early stage and can do a deep dive. In that way, the science can get into the DNA of the storytelling. An example is in *Agent Carter*: they had this exotic material they wanted to use throughout the second series, which I advised on based on knowledge of real life exotic materials. This was everything from containment of a substance you can't touch to how they might move this substance (I suggested magnetic fields) and designing machines which they built and used on set.

**How detailed does it get? Do you sneak things in?**

In season two of *Agent Carter* I filled the blackboards in Howard Stark's lab with period-appropriate equations, modified slightly to relate to the problems they were trying to solve. Maybe me and one other person would appreciate those. Sometimes, I know the history of the characters better than the writers – because I'm old! So I'll suggest dialogue that references the comics.

**To what degree have you tried to influence the direction of the MCU?**

As *Agent Carter* was about the early days of what would become SHIELD, I began suggesting that this would be a good point to start building a reference framework that could be used for the future films, particularly with regards to the energy sources that later became the Infinity Stones. I offered to help them write the physics rules for them, so that they would be consistent from film to film, but no one got back to me. I think I was being a bit optimistic about how much they wanted me to worry about that stuff!

**What's the most important thing to get right?**

I want to give people the opportunity to recognise that everyone can be involved in science. In the comics, people like Tony Stark do "science"; he can do anything in any scientific discipline. I wanted to change that because science is a collaborative field. In *Infinity War* they did a really good job of bringing in Shuri. Representation of people doing science in the MCU has evolved from just white men. **Tom Ward**





## Science non-fiction: five things Marvel gets right(ish)

### 1. Thor's hammer

"In the 1960s, scientists were looking at neutron stars made of incredibly dense material; the writers thought that's what Thor's hammer could be made of. On *Thor: Ragnarok*, I suggested that Asgardian weapons were made by a star."

### 2. Infinity Stones

"In the astrophysical realm, there's a lot of weird stuff made from incredibly strange materials. Of course, we don't have shiny space gems, but the idea that you have relics left over from the early universe that are still around today is accurate."

### 3. Quantum realm

"The world we live in is dominated by classical physics, like Newton's laws of motion. These do not apply when you get to a certain scale. At that level, quantum physics becomes the dominant physics, and the rules that apply there are totally different."

### 4. Science/society

"*Black Panther* really showed how science and technology reflects a society's culture and the people who work on it. Marvel did a great job by making Wakanda's technology and science look and feel very different from what was seen elsewhere."



Clifford Johnson's scientific advice ensures Marvel's heroes don't break too many laws of physics



# WIRED insider

Events, new products and promotions  
Compiled by Jake Pummintr



**Oris Limited Edition Roberto Clemente  
40mm watch** £1,350 [oris.ch](https://www.oris.ch)

A special edition commemorating baseball Hall of Famer Roberto Clemente, this watch is limited to 3,000 units, representing Clemente's career hits. It features a stainless steel case and the Oris 754 movement.

**Tudor Store Opening, Westfield, London**  
[tudorwatch.com](https://www.tudorwatch.com)

Watches of Switzerland has teamed up with Tudor to open Tudor's first standalone store in Europe, at London's Westfield Shopping Centre in Shepherd's Bush, showcasing its extensive range of unisex timepieces.



**Fujifilm X100V camera**  
£1,299 [fujifilm-houseofphotography.com](https://www.fujifilm-houseofphotography.com)

With plenty of features for both pros and amateur photographers alike, the X100V packs in a 23mm F2.0 lens, X-Trans CMOS 4 sensor, and an advanced hybrid viewfinder – all wrapped in a cool retro-style aluminium body.

**FOREO LUNA 3 facial cleansing device**  
£169 [foreo.com](https://www.foreo.com)

Delivering up to 8,000 T-Sonic pulsations a minute, the waterproof, app-connected LUNA 3 lifts 99.5 per cent of built-up dirt, dead skin and oil from your face. Select cleansing or massage mode, and prepare to be purified.



## THE INSIDER EVENT EDIT

### WIRED FORESIGHT Ongoing

WIRED Foresight with Greg Williams continues its compelling discussions with influencers and innovators. In recent sessions, we've investigated deepfakes with political broadcaster Nina Schick; the future of the AI ecosystem with Arm director Kate Kallot; and the analogue revolution with technology historian George Dyson. *Find out more on [wired.co.uk](https://www.wired.co.uk)*

In consideration of the impact of Covid-19, WIRED has confirmed a virtual-only option for its conferences running until December 2020. Details of any in-person experiences will be shared closer to the event date, and all ticket rates have been adjusted accordingly.

### WIRED SMARTER [wired.uk/smarter](https://www.wired.uk/smarter) October 13-15, 2020

WIRED Smarter's annual B2B event explores the nascent trends in business, retail, money, the future of work and sustainability. This year's speaker faculty includes barrister Cherie Blair, SWAY author Pragya Agarwal, IKEA chief digital officer Barbara Martin Coppola, and Black Girl Ventures founder Shelly Bell.

### WIRED LIVE [wired.uk/wired-live](https://www.wired.uk/wired-live) November 24, 2020

WIRED Live – the inspirational festival for innovators, entrepreneurs, strategists and designers is back. Its talks will offer a multi-faceted perspective on the future of technology, design and culture. Speakers include DeepMind co-founder Demis Hassabis, artist and stage designer Es Devlin, and architect Bjarke Ingels.



H

**ype tends to be denounced as the fuel** of the substandard, the fraudulent and the disappointing. It's what we blame when companies, technologies or ideas dominate the public consciousness, only to let us down; the invisible force that tricks us into believing the con; the eye-roll-inducing words that tell us to over-invest our time, money and faith into unique "solutions" that within a few months will turn out to be useless.

In short, hype is seen as the domain of hucksters and snake oil salesmen

peddling the ordinary as exceptional. And hype has another, pernicious role – that of current-day distraction. In science and technology, it often amounts to a distraction of the public gaze away from underrated innovation, and towards that which more easily captures attention. Away from the good stuff, towards the shiny stuff.

The *Cambridge English Dictionary* defines "hype" as a deception of sorts, a trick deployed "to make something seem more exciting or important than it is"; the *Oxford Dictionary of English* is more forgiving in its description: "extravagant or intensive publicity or promotion". Hype has different definitions and connotations, then, depending on whom you ask or what dictionary you consult. And per se, hype is neither good nor evil: it's a tool. It can be the catalyst for genuine

innovation to get funding, attention and regulatory consideration, and it can do the same for something not so legitimate.

The problem: fostering hype takes time and money. And not everyone who is working on the good stuff – innovation that is impactful, useful, entertaining or just original – has the time and money to buy hype. Hype, therefore, isn't necessarily a fair measure of science and technology worth paying attention to.

Take fusion energy: a technology that has the potential to change energy production worldwide, and reduce society's reliance on fossil fuels. A technology that has brought together 35 nations to work on a \$25 billion science experiment in southern France. A technology which requires solving a problem so easy to explain: recreating the Sun's power on Earth. Yet, despite growing awareness of the climate crisis, and the "tech will save us" narratives, fusion energy is often confused with current nuclear power stations (nuclear fission), is branded pseudoscience (due to the conflation with cold fusion) and is something most people will happily admit to knowing nothing about. There's just no social pressure surrounding it as a trendy idea – unlike AI, blockchain, or Elon Musk's scheme du jour.

It might seem unimportant to have more people talking about fusion energy when there is still much to be done to bring it to market. But as the world scrambles for new green policies and environmentally-friendly corporate practice, one would think fusion energy might at least be hailed as a promising technology. Right now, any mention of it is instead met with blank faces. The same cannot be said for the hype surrounding electric cars, or solar panels, or household recycling schemes.

Hype is not simply a distraction. It can have a subtler, more devastating effect: it dilutes awe. Exhibit A for this problem can be found in the field of astrobiology. That might sound surprising, as astrobiology is the discipline studying, in Nasa's words, the "origins, evolution, distri-

SCIENCE  
SHOULD  
NEVER  
BELIEVE  
ITS OWN  
HYPE



Getting people excited about new discoveries is important – but not at the cost of real research

Gemma Milne is a science writer, and author of *Smoke & Mirrors: How Hype Obscures the Future*







Science has an attention problem, but it also needs to avoid trivialising itself

bution and future of life in the universe". Pretty wow, right? Yet one single word has proven able to make anything coming out of the field seem far-away or far-fetched. That word is "aliens".

Public coverage of missions to Mars focus on the searching for alien life over more consequential questions such as whether previous missions to the planet have corrupted future experiments by

inadvertently transporting biological material from Earth, or what kind of terrestrial life could travel on the outside of a spaceship all the way to Mars, or what constitutes "life" in the first place.

Most of the stories surrounding SETI (Search For Extraterrestrial Intelligence) and METI (Messaging Extraterrestrial Intelligence) focus on the quirky individuals who have these "crazy ideas" about listening for and speaking to aliens to see if we're not alone. They don't let the public in on the fascinating process of trying to work out exactly what counts as an intelligent alien message in the radio signals received, or let the public ponder what kind of messages we

Hype is not simply a distraction. It has a subtler, more devastating effect: it dilutes awe

should be sending out to other lifeforms, or give them permission to delve into the question that is actually at the root of what these scientists are working on every day: who are we?

Acting this way has a cost. It's not just about allowing people to feel awe: it's about empowering those who are not professional scientists or technologists to be able to participate, instead of being spoon-fed a whizz-bang watered-down version of science as cheap entertainment. Hype doesn't just obscure the reality of what's going on in science and technology – it makes it less interesting. It's time we start to look past it and delight in what lies beyond.

ILLUSTRATION: ANDRÉS LOZANO. SPOTS: MATTHEW GREEN

## Early Adopters WIRED asks three entrepreneurs for their high-impact hacks



**Hema Chauhan**  
Founder  
of Curlicue

"One book had a huge impact on me: **Originals** by Adam Grant. It totally revolutionised my view of creativity and originality. The subtitle, "*How non-conformists move the world*", captured me – it set me on a journey to create Curlicue, and I recommend it to people who need to feel inspired."



**Grace Regan**  
Founder  
of SpiceBox

"**Cold water** – I can't believe how powerful it is! In the winter I really recommend swimming in Parliament Hill lido, which can get down to 6°C. For the summer, a chest-freezer ice bath works well. I find cold water as effective as meditation in clearing my mind."



**Rachael Nsofor**  
Founder of  
plsLONDON

"I was an early adopter of **hair jewels** because of the show *Selling Sunset*, which aired on UK Netflix. Lead character Christine Quinn changes up her look with faux extensions and hair bling in every episode. Could this be the reason why she's the most successful realtor in the show?"



**FUJIFILM**  
**X | GFX**



# MASTERS OF DESIGN

Over 80 years of experience in photography goes into every camera we make, so you can be sure they always handle perfectly

FUJIFILM-X.COM



**Mohamed Taha's ambition to disrupt the** fertility industry began after his first sperm test. According to the World Health Organisation, a normal sperm count is around 15 million sperm per millilitre (m/ml) of semen. Taha's sperm count was 15 times lower.

Concerned, he chose to do a second analysis at a different clinic: the result a more positive 20 m/ml. A third analysis gave a sperm count of 3 m/ml. "It was frustrating," he says. "Every time I did a test I would get a different result."

The reasons for the discrepancy: most fertility clinics don't employ andrologists – specialists in male reproductive systems; sperm analysis often doesn't follow the gold standard WHO protocol; and tests are often done manually, using antiquated equipment.

"Doctors told me that, as a man, I shouldn't worry about my fertility," he says. "All they needed was one sperm – and my partner could get in-vitro fertilisation (IVF) treatment."

Taha found this unacceptable, adding that few couples are told that the overall chance of success for IVF is 25 per cent, and in half those cases IVF fails due to a problem with the man's sperm. In 90 per cent of the cases, men are never assessed properly by an andrologist.

Taha, who was doing a PhD in nanotechnology at the time, thought he could do better by applying AI and nanorobotics to the problem of human fertility. He founded Mojo in 2017, with co-founders Daniel Thomas, Fanny Chesa and Tobias Boecker. "We wanted to get rid of the human error factor entirely."

By 2018, Mojo had developed a smart microscope that could automatically scan a sample of sperm and analyse it. Mojo Assess is powered by a computer vision algorithm trained on millions of sperm images labelled by expert andrologists. It can compute sperm count, sperm motility, the predominant shape of the sperm and other parameters like the integrity of the sperm's DNA. It has been tested in clinical trials conducted at the best fertility institutes in the world, including The Doctors Laboratory, King's Fertility, and the Karolinska Institute, in Solna, Sweden.

According to these tests, Mojo Assess results show a 97 per cent agreement with the gold standard analysis done according to the WHO guidelines. Furthermore, Mojo's technology can perform a test in four minutes; WHO protocols typically take 30 minutes and two lab technicians to complete. "Healthy sperm is half of a successful IVF process," Taha says. "When properly evaluated and selected, we increase its chance of success and prevent unnecessary treatments." **João Medeiros**

Right: Mojo's smart microscope can assess sperm samples to the World Health Organization's gold standard for analysis accuracy



## SAMPLES REMIXED

AI and a smart microscope are tackling a crucial part of the fertility equation – men's sperm count



Above: Mohamed Taha holding a glass sperm-sample slide, ready for AI analysis



T

**hink of American whisky and you'll** likely picture the bourbon producers of Kentucky. But over the past decade, more than 160 distilleries producing single malt have sprung up across the US. Among the first was Seattle-based Westland Distillery, run by Matt Hofmann, a specialist in blending traditional craft with the disruptor culture of his hometown.

"I love Scottish whisky, but right from the start our goal was not to make a carbon copy – it's not interesting and it's not honest," he says. "We wanted to make something authentic to our home in Seattle." And handily, the Pacific Northwest region is also perfectly situated for making single malt whisky.

Traditionally, single malts get a lot of their character from the casks in which they age, and the length of time they spend in them. For Hofmann, the opportunity in setting up a whisky business half a world away was to think completely differently, using his interest in taste, combined with a degree of savvy about what his home state has to offer (as well as good barley, there are peat bogs and indigenous oaks). "Imagine a winemaker that didn't focus on the type of grape it used," he says. "That's how I feel about whisky and barley. The entire single malt industry uses less than five varieties of barley; in ten years we have already used 18, and this range gives us an entire spectrum of malt flavour. Most commercially-farmed barley is chosen for its yield rather than



Seattle's Westland Distillery combines traditional craft with modern methodologies

its flavour; we've worked since 2012 to cultivate more flavourful varieties and, through The Bread Lab at Washington State University, we've sponsored a PhD student whose research – all open-source – will deliver new strains."

The upshot of this is whiskies that take only 4-6 years to reach maturity, with ABV levels above 45 per cent to avoid the need for chill-filtering – another standard process for many single malts that removes flavour compounds – and no artificial colourings. But how do they taste? We got to sample the three single malts that make up Westland's core range; the American Oak, Peated and Sherry Wood, and it's a rich menu, running from the orange and dark chocolate of the American Oak to the oaty, buttery smoothness of the Sherry Wood.

**'The great thing about American Single Malt is that we've got the freedom to adapt single malts to be whatever they can be'**

And that's before we get to Westland's showstopper, the Garryana. Aged in oak casks from *Quercus garryana*, a species of oak native only to the Pacific Northwest, it is released annually as a limited edition run (the next batch lands on our shores in November). The initial experience is not unlike a premium rum, with a strong hit of molasses and dark fruit before the more predictable edge of single malt kicks in. It's the ultimate proof that single malt can be thought of in terms that go far beyond smoke, peat and oak.

"I'm not saying one way is better or worse – it's just different," explains Hofmann. "The great thing about American Single Malt is that we've got the freedom to adapt single malts to be whatever they can be." [westlanddistillery.com](http://westlanddistillery.com)

## Celebrate the past, drink to the future

A single-malt revolution in Seattle is elevating whisky making with an approach that values craft and tradition – but with a disruptive spin



E

**xploring the streets of a city is a joy** known to many. When that city is the culture-filled Vienna, it is the experience of a lifetime. As the afternoon sunlight hits the white stone walls of the Vienna State Opera, it highlights everything the city stands for – music, architecture and history. Tourists flock to see the Schönbrunn Palace and St Stephen's Cathedral, to watch concerts and visit museums. The likes of Beethoven,

Mozart and Freud once called the Austrian capital home, and Billy Joel and Ultravox were inspired to sing pop hits named after it. But even Vienna's most seasoned residents won't know all the secrets of the city – like which of Vienna's museums has 6,000 year-old make-up palettes, or displays fossilised dinosaur excrement you can touch, or where the equipment needed to heave Empress Maria Theresa into the Capuchin Crypt on her visits is kept?

To assist you in discovering these surprising treasures, the Vienna Tourist Board has created ivie – an app that can tell you everything you need to know.

"Ivie is the ideal companion for anyone who wants to explore Vienna for the first time, and for experienced connoisseurs of the city who would like to discover its unknown sides," says Norbert Kettner,

CEO of the Vienna Tourist Board.

When visiting cities as a tourist, huge maps and guidebooks aren't the most practical option, especially when trying to travel light. Ivie combines everything you will need for your trip in one app.

It can show you just about anything you need to know about the city, from exploring Beethoven's Vienna via a walking tour with an audio guide, which brings you through the city centre where many of his works were first performed, to a modernist excursion and the Vienna of artist Gustav Klimt and psychoanalyst Sigmund Freud.

Before you begin, ivie will tell you how long your walk is expected to take and which key sights will be en route, and you can decide your start and finish points depending on what you want to see.

The app is rich with photos and videos to show you the city in fine detail and to make getting around easier. There are plenty of little stories and anecdotes linked to places around Vienna, and activating notifications will allow the app to send an alert when you get close to something special.

The app creators wanted to ensure that ivie is not only enlightening, but also very practical. Its built-in map will show you where you need to go, and allows you to mark important locations such as your hotel, so you can always find your way back. Ivie also knows the whereabouts of drinking fountains and city bike stations – and if you need the toilet on your travels, it can show you where the nearest public restroom is. You can also browse and save sightseeing favourites in advance, so that you have a handy to-do list when you get there. Ivie even lets you know what the weather forecast is so you can plan your day accordingly.

Ivie also gives access to the Vienna City Card, which provides free travel on public transport starting with your airport transfer, as well as discounts on museums, restaurants and tourist attractions. The Vienna Tourist Board has made ivie available in both German and English, for iOS and Android devices – visit [vienna.info](http://vienna.info) for more, or download from the Apple App Store or Google Play.

# Explore Vienna with an expert in your pocket

Tourists in the Austrian capital have a high-tech companion to help them get the most out their visit: meet ivie, the app that knows the city inside out



The ivie app can create tours of Vienna tailored just for you



# OVER THE MOON

Sorry, Disney – Netflix is ready to launch its own animated features, and it's aiming high

**Ken Keane** spent almost 40 years as an animator at Disney, but his feature length directorial debut is launching on Netflix – now a major competitor to Big Mouse in the streaming wars.

*Over the Moon* is an animated musical based on the Chinese legend of the lunar goddess Chang'e, and follows Fei Fei, a young girl who builds a rocket to the Moon to try and meet her.

Keane cut his teeth in hand-drawn animation, but says he worked hard to retain a human element to the CGI. Rather than using an actor as a model for the animators to use in each scene, he asked them to film themselves acting out different expressions.

Computer graphics have given animators more powerful tools to create the subtle micro-expressions that we don't consciously notice, but which transmit emotion, he says. "Like the corners of the characters' mouths, the way the lips fold in and turn – those were all based on observation and study," Keane explains.

In the second half of the film, Fei Fei makes it to the Moon and discovers Lunaria – a magical kingdom which posed a technical challenge for the animators. Its design was inspired by the art of Joan Miro, and the cover of Pink Floyd's *Dark Side of the Moon*.

One of the biggest considerations was lighting and colour. In scenes set in rural China, production designer Celine Desrumaux focused on textures and how they reflected sunlight.

On Lunaria, the unlit dark side of the Moon, everything is lit from within. The creatures and buildings of Lunaria glow – which meant careful choreography was required to make sure Fei Fei and the other human characters remain visible. "You can't light the front of the character if the source of the light is behind," says Desrumaux. **AK** *Over the Moon* is in cinemas from October 16 and on Netflix from October 23

ANIMATORS AIM TO CAPTURE EVEN SUBTLE FACIAL MICRO-EXPRESSIONS

ANIMATORS FILMED THEMSELVES TO GET THE FACIAL QUIRKS RIGHT

"RANDOMNESS" ISN'T EASY IN CGI, SO FEI FEI'S HAIR TOOK MONTHS

DESIGNER JIN KIM SAYS CGI ALLOWED A WIDER RANGE OF TEXTURES

YOUNGER CREW MEMBERS HELPED GET ASPECTS OF MODERN CHINESE LIFE CORRECT

ON THE MOON, FEI FEI IS LIT BY LIGHT FROM CHARACTERS THAT GLOW





**Need a change?**

**Find your perfect new role at the  
newest networking and job site.  
[wired.co.uk/hired](http://wired.co.uk/hired)**



**WIRED**  
**Hired.**

POWERED BY JOBBIO



# WORK SMARTER

EDITED BY  
NATASHA BERNAL

PHOTOGRAPHY BY  
ADAMA JALLOH

ILLUSTRATION BY  
MANSHEN LO

*Right:*  
Gift Ajimokun,  
an independent  
D&I consultant

## Make change

What organisations  
can do to champion  
workplace diversity



## Faced with the BLM movement, company leaders have passed the buck

**THE DEATH OF GEORGE FLOYD**, a Black American man killed by police during an arrest in May 2020, sparked a global anti-racist movement. As companies scrambled to show their support, they found themselves in an awkward position. They realised they could no longer avoid addressing racial inequality and institutional problems within their own organisations, so they quickly issued a plethora of statements and pledges outlining grand plans to finally solve the issue.

But businesses don't have structures in place to ensure accountability. Rather than senior leadership doing the legwork, the responsibility has fallen to non-white hires, who are not remunerated for additional labour, or to diversity and inclusion officers, some newly contracted in the wake of the Black Lives Matter movement.

"A lot of organisations are ill prepared to deal with these sorts of things and many aren't actually particularly interested in actioning change," argues Bayo Adelaja (*shown right*), a D&I consultant and founder of Do it Now Now, an organisation that seeks to empower members of the Black community. "They say 'We're educating ourselves', but don't know how to actually fix the problems at hand, so look to those who have actually experienced those things. The problem with that is that the Black people within an organisation don't usually have the power to fix anything."

Pointing to diverse hires to solve the problem that made them a minority in the first place seems to some management like an easy fix to a much larger problem – and this isn't lost on those who have been burdened with the challenge.

Fiona\* is part of a diversity network within a major financial services firm which has received renewed attention in light of recent events, after previous attempts by the network to implement anti-racist practices within the firm had been overlooked. While this appears to be a positive step, she points to an "incredible onus" to tackle structural issues within the company. "We've been implementing HR policies and training to diversify the talent pipeline and improve company culture. To balance that alongside our daily jobs that we are actually and contractually paid to do is tough, considering that D&I is now a hot trend," she says. "Many of us are working extra hours to help create these strategies because we're passionate

'A lot of organisations are ill prepared to deal with these sorts of things, and many aren't particularly interested in actioning change'

CHANGE  
MAKING

about it; however, against the backdrop of Covid-19, it's mentally exhausting."

For many within D&I networks or in consulting positions, the newfound attention towards anti-racist practices is long overdue. Senior management has repeatedly ignored frameworks that were previously presented to them, showing the scale of the problem. Gift Ajimokun, the former chair of Colour[full] at Penguin Random House and an independent D&I consultant, points to her experience at the publishing house and frustration around getting anti-racist policy implemented. "I put together a report on Black and Brown employees' experiences which I shared with the CEO, complete with action points and areas of improvement," she says. "I had good feedback but didn't actually see anything come of it. If they're smart, rather than consulting employees again and relying on emotional labour, they'll refer to that report, as everyone has already said what needs to be said. It's waiting there in their inbox."

While some companies have taken the step to address structural inequality via workshops and unconscious bias training, it's often the case that sustained effort is needed to really result in any concrete change, as Meera\*, a brand strategist, found after running a workshop. "Our leadership team committed to a number of actions including funding the training; but, it became clear that no one was taking responsibility for actioning anything so I took it on as extra work," she says. "Our MD told me to look into different training providers and I came back with quotes that were deemed to be too expensive. When we eventually did have D&I training – which was done by a friend in exchange for some free work on our part –





Bayo Adelaja, a D&I consultant and founder of Do It Now Now



HOW DIVERSE IS BRITISH BUSINESS?

3.3%

Only 3.3 per cent of chairs, CEOs and finance directors are from BAME backgrounds. The number of BAME board members fell from nine per cent to 7.4 per cent in 2019.

2066

This is the year, according to D&I consultancy Green Park, that FTSE 100 companies are predicted to meet boardroom diversity targets, at the current rates of progress..

+1/3

Over a third of Britain’s largest listed companies are likely to miss a target to have at least one ethnic minority director by 2021. Of the FTSE 100, 47 firms have no board-level people of colour.

9

In total, there are currently just nine non-white chief executives or chairs in the FTSE 250. About 69 per cent of the companies on the FTSE 250 list have no directors of colour at all.

51

Green Park also found that of the 1,097 most powerful roles it identified in UK business, politics, policing, media, education and sport, only 51 were held by people from ethnic minorities.

3.4%

The Colour of Power index shows that 3.4 per cent of high-powered positions go to men of colour, and just one per cent to women of colour.

*Continued >*



much of the leadership team didn't attend, instead going to a boozy lunch."

As Covid-19 caused companies in all sectors to struggle financially, the extra cost of external D&I consultants or new hires can be viewed by managers as a burden on the balance sheet. "Consultants aren't generally cheap, so organisations need to find the budget where they didn't already plan for it," Adelaja says. "D&I officers tend to be shunted to the side because they're not bringing any money in themselves. Ultimately, they're considered to be a cost."

If reshaping an unequal structure is truly something that company leaders believe in, it's an investment worth making. "If you see spending money on anti-racism as a cost, you automatically see it as something that is taken away from what you already have," argues Ajimokun. "It's seen as a risk more than anything. If you view it as a long term investment, then it's something that will benefit your company in the long run and that initial cost is recouped and then some." Research by Deloitte in 2018 put a

'If you see spending money on anti-racism as a cost, you automatically see it as taking away from what you have'

number on the benefit of D&I: it enhances innovation by about 20 per cent.

Given the historical and systemic nature of institutional racism in large organisations, these aren't issues that can be resolved in a few months by people who are not given the power to actually enact permanent change.

"Black people need to feel empowered to speak without any fear of consequences," Adelaja says. "If you don't empower those groups to make changes in your organisation, they will leave that company in search of an employer that will actually understand and value them. It's really incumbent upon the senior management to open up spaces for this conversation, but also empower those groups to change things within the organisation." **Jumi Akinfenwa**  
\*Names have been changed

#### Five reasons why diverse companies are more successful

**1** Companies with more diverse management are 25 per cent more likely to make more revenue, according to a study by McKinsey. Researchers found that the greater the diverse representation, the higher the likelihood of out-performance.

**2** Shares in companies with more women performed better than their competitors during the coronavirus crisis, according to an analysis of FTSE 250 companies by New Street Group. Shares in the top 25 FTSE 250 companies with diverse boards fell in value by an average of 24 per cent since the start of 2020; their competitors' share prices fell 29 per cent.

**3** Research by job site Glassdoor shows that 67 per cent of job seekers look at workforce diversity when they are offered a job. Top female candidates in the US and Europe prioritise gender diverse work environments.

**4** Gender diversity across an entire company signals to investors that a business is well run. Research on market valuation suggests that investors value when firms use "best practices", such as inclusion of diverse groups in hiring.

**5** A diverse team understands the end user better and will produce more successful ideas. A team with a member who shares a client's ethnicity is 152 per cent more likely than another team to understand that client, according to research from Harvard Business Review. **NB**

## Workplace meritocracy is a myth: we need more transparency around who gets promoted, and why

**POWER IN BRITAIN LOOKS EXACTLY** the same as it always did: increasingly white, male and concentrated in the hands of a few. Diversity at leadership level is still practically non-existent and it's barely moved in the last three years, according to data from a report by D&I consultancy Green Park. Only 51 of the 1,097 most powerful roles in business, media, politics, policing, education and sport in the UK are held by people from ethnic minorities. That amounts to just 4.7 per cent, despite the fact that they make up 14 per cent of the population.

Although British businesses pledged their support for Black Lives Matter after the murder of George Floyd in the US, Black people in particular remain woefully under-represented, with only 16 senior leaders in the UK.

Companies have ignored the elephant in the room. Meritocracy is flawed, and society is riddled with bias and racism that fundamentally stops opportunities from spreading widely and fairly.

Talent is everywhere but opportunity is not – the only thing that continues to separate Black people from anyone else is the lack of the latter. Like many, I went into the workplace thinking that you've got to put your head down, work hard and

#### THE VICIOUS CYCLE OF MALE, PALE AND STALE FUNDING

The British Business Bank says for every £1 of UK VC investment, all-female founder teams get **LESS THAN 1p**, all-male teams get 89p, and mixed-gender teams get 10p.





BEATING  
BIAS

you'll be noticed and rewarded for it. I was wrong. What I encountered was how people's backgrounds were a key indicator of who was continuously being propelled forward in their careers.

The Black Lives Matter movement this summer highlighted something those from minority backgrounds already know: if you do not fit the traditional mould of what success looks like, opportunities are few and far between.

In an ideal world, you'd be hired and promoted based on ability, but to say that is happening in Britain in 2020 is far from the truth. When businesses are confronted with the need to change, they can quickly turn to tired phrases like "we only promote based on merit,

not gender and ethnicity" or "we don't want to be seen to discriminate against white people". Ultimately, this sends a message to everyone else that the reason leadership and the echelons of power are overwhelmingly white and male is because they deserve to be there: these are the most talented, hardest workers and the most intelligent. This is not just offensive and absurd; it doesn't delve deeper into the problematic criteria that we use to determine merit.

*Below: minority workers get fewer opportunities to take more senior positions*



**83 PER CENT** of deals that UK VCs made last year had no women at all in founding teams, even though 47 per cent of the national workforce is female.

Only **27 PER CENT** of the workers at UK VC firms are women, and they only represent 13 per cent of decision-makers – 66 per cent of firms have no women decision makers at all.

**13 PER CENT** of money invested in businesses in 2018 went to female-founded ones, according to data collected by Beahurst.

The UK's Investment Association, which represents fund managers, said in 2019 that Black people make up **LESS THAN ONE PER CENT** of that industry.

We need to let go of the myth of an achieved meritocracy. Research from MIT revealed that companies with meritocratic values are often the most biased. In a purely meritocratic environment, biases and stereotypes are accentuated; managers believe they are more impartial, and unknowingly give themselves permission to act on their biases. The authors of the study concluded that "merit-based pay practices in particular may fail to achieve race or gender neutral outcomes". They call this the "paradox of Meritocracy". We need greater transparency on not only who is being promoted, but why.

At current rates of progress, proportional representation among Britain's top leaders will not reach 13 per cent until at least 2044. The businesses that recognise the opportunity this offers and invest in the talent now will stand out both commercially and culturally. To be in denial is to be left behind.

Imagine the unintended consequence this is having for many individuals: when you see the same people in positions of power time and time again; when you're overlooked for career opportunities; and when you're uninspired by the lack of senior role models. Out of sheer frustration, you're likely to end up leaving to create your own opportunities. A New York University study on self-employment found that the same stereotyped conceptions that plague women and minorities within the walls of a corporate office exist outside too, but that people who run their own businesses feel these problems are more manageable. As entrepreneurs, they have more power to solve these issues than when stuck at the mercy of others in the corporate setting.

Entrepreneurship isn't the answer for everyone and should not be a solution for a system that overlooks talent in favour of the myth of meritocracy. We don't need more empowerment, we need opportunity. If we fairly draw from all of society's talent pool, leadership would look vastly different. 2020 was a year of upheaval, when we have seen how much around us is broken at a very deep and structural level. We must move from the passive to the active. If not now, then when? **Elizabeth Uviebinené is the author of *Out of office: Why isn't Work Working?*, out February 18, 2021 (Hodder Studio)**



*Below:* author  
and political analyst  
Saurav Dutt

ALGORITHMIC  
INJUSTICE

AI IS REINFORCING BIAS



‘The more foreign sounding your name is, the greater the assumption that your English might not be to the same level as a “native”. Recruiters have looked for tell-tale clues to validate this assumption’





**DO YOU PLAY NETBALL, HAVE AN UNUSUAL** name or have been made redundant due to the coronavirus pandemic? If the answer to any of these things is yes, you could face an uphill battle for securing a job over the next six months, especially if the company you're applying to join uses artificial intelligence (AI) to aid recruitment.

Companies are using flawed historical data sets to train their AI, which means that women, Black people and people of colour could find themselves discriminated against before they've made it to the interview room. According to Frida Polli, a former academic neuroscientist at Harvard and MIT, and CEO of Pymetrics,

The coronavirus crisis has already cost hundreds of thousands of jobs. According to the Insolvency Service, employers were planning to make at least 139,000 redundancies in June. In July, out-of-work benefit claims reached 2.7 million, according to the Department of Work and Pensions; 45 per cent of these were a result of people losing their jobs during the pandemic. When furlough support ends in October, companies looking to hire staff could face a tsunami of applicants.

But if they use AI to lighten the load on HR departments, they risk simply transferring existing bias on a mass

could single out demographic groups such as women or younger adults. "There are sports that are only played by women or men," she says. "If this appears in the hobbies or soft skills section of your CV, the AI could remove you from the application process."

While discussions are happening across all industries to attempt to close the gender gap and foster better representation of BAME demographics, author and political analyst Saurav Dutt says bias still exists in recruitment.

Born in Kolkata, India, and raised in the UK, Dutt has found that something as simple as his name can skew job opportunities. "The more foreign-sounding your name is, the greater the assumption that your English might not be to the same level as a 'native'," he explains. "Recruiters have looked for tell-tale clues to validate this assumption such as poor syntax, grammar, broken sentences – elements where a white person would be given the benefit of the doubt."

Dutt also admits to "whitening" or "white-washing" his CV by, for example, changing his name to "Rav", which he says has brought him more job opportunities, and removing anything linking to India or his religion, Hinduism. "It is more a case of actually including 'whiter' skills such as writing political columns, editing, golfing, tennis and running," he explains. "I also included 'well-rounded' languages, for example, German or French, as opposed to Bengali and Hindi, which are the languages associated with my upbringing."

While some companies may not yet have implemented an AI solution for its recruitment drives, Deloitte's technical director of privacy, Ivana Bartoletti, believes that the Covid-19 pandemic will mean more will do so at "rocket speed", which she finds concerning.

"Transforming with AI is a complex process that requires checks and balances and proper involvement of employees and workers," she explains. "In HR, issues related to algorithmic racism and inequality must be taken seriously and companies need to ask themselves what they need and why it is necessary."

"Automated decisions can lock people out of jobs and I am afraid current General Data Protection Regulation (GDPR) legislation is unfit to deal with the problems we face." **Sophia Waterfield**

## The job market is broken – and AI recruitment is making it worse

AIs can be compared to toddlers, in that they learn from the humans around them. "They look at the world and say, 'I'm gonna learn from that'," she explains. "AIs are learning from the origins of bias – the human brain."

Polli argues that companies do not audit their data before training the AI – or once it's live. "I'd say over 90 per cent of programmers are not auditing their data," she continues. "Humans are perpetuating bias and are unchecked, resulting in unchecked algorithms."

scale. Back in 2018, Amazon had to scrap a machine learning program it had been using to sieve through job applications because of the use of historical data. It turned out that because of the traditional hiring choices of the past, the AI did not "like" women. This could happen again if companies do not act quickly.

Job applicants during the pandemic could also be discriminated against for gaps in their CVs because of redundancies and career breaks, says Raluca Crisan, co-founder of AI bias analysing company ETIQ. "If an AI has a timeline feature, which evaluates the timescale of being at a job, people could be penalised due to redundancy or shorter times at jobs, caused by Covid-19," she explains. "The discrepancies in the data could mean that the top talent could be culled, resulting in smaller talent pools of candidates."

AIs that also review keywords within CVs and base them on previous hires

**OWN GOALS:**  
**LISTING A SPORT**  
**ON YOUR CV**  
**COULD CAUSE AN**  
**AI TO ASSUME**  
**YOUR SEX – AND**  
**EXCLUDE YOU**



## Workplace diversity is about inclusive culture, not token hiring

**ON A GLOOMY MONDAY AFTERNOON** last September, Sam\* was ushered into a meeting room to interview for the role of charity director. She was aware that this organisation had been through a race-related scandal in the past, but was confident and prepared for the interview. But as it began, she noticed something unusual. “The people interviewing me didn’t appear to have read anything about me, either from my CV or cover letter, as the kind of questions being asked were areas I’d already covered,” she explains.

Although Sam accepted the job, she was convinced that she was a token hire, which triggered self-doubt and knocked her confidence. “It made me question if I was deserving of the things I had worked so hard for, and it fed the already existing imposter syndrome I had,” she says.

Black Lives Matter (BLM) has reignited a discussion around the make-up of organisations and how they prioritise diversity and inclusion. Companies such as Barclays, Deloitte, and the BBC have all pledged to increase the number of Black employees in their workforce. Glassdoor reported a 50 per cent surge in diversity and inclusion job openings in June alone. But one thing missing from this discussion is this concept of “token hiring” – a quick-fix to diversity that we may now see become a lot more common.

A recent McKinsey report found that 61 per cent of employees don’t believe their workplace is inclusive. They concluded that hiring diverse talent is no longer enough, because companies can recruit people to artificially meet a target and still not provide inclusive work environ-

ments, which could then contribute to employees feeling stuck as token hires.

“Token hiring is just window dressing with no real commitment to infrastructural change or challenging problematic behaviours around inclusion or culture,” says Christina Brooks, co-founder and CEO of Ruebik, a company that specialises in diversity-focused software.

Tanya\*, a business advisor for a music company, says that since she was hired in January 2018, she’s been the only Black woman in the company. She quickly found that she was being reprimanded for the things that white colleagues would get away with. And she watched these same colleagues being promoted ahead of her, even though most had less experience.

“Despite consistently reaching my targets and managing complex cases, I was rejected for all three role-promotions I interviewed for,” she explains.

This attitude convinced Tanya that she was a token hire, causing her stress and frustration that led to her leaving the

company. “[They] only wanted a token Black woman and did nothing to support my career or progression,” she says.

Companies that now want to bring on more diverse employees need to look at the make-up of senior leadership and recruitment firms they use. “If [they] don’t understand the communities they’re now trying to permeate, then diverse talent isn’t understood, and is simply placed into the process because they’re diverse,” Brooks explains.

BLM has put the spotlight back on diversity within business, but companies need to make sure that this isn’t done through panicked token hiring. Education and training is needed for employers when it comes to understanding diversity, while also making sure that diverse voices play a part in the hiring process, Brooks argues. “This ensures that when a diverse employee is hired it’s because they are the best person for that role, and not just because of who they are”. **Shahed Ezaydi**

*\*Names have been changed*



‘Token hiring is just window dressing with no real commitment to infrastructural change or challenging behaviours around inclusion or culture’



T

here's a common misconception about Covid-19: that the virus has sped us from 2020 to 2030 overnight. However, there's still a kernel of truth to this idea: right now, a great many companies are practicing "distributed work", in which employees are working remotely. But while behaviours have adapted, we rely on the same tools that were available before the pandemic. So, what are the emerging technologies that will transform remote working in years to come?

To Bharat Mediratta, chief technology officer at Dropbox, the quarantine experience has highlighted a huge gap in the market. "What we have right now is a bunch of different productivity and collaboration tools that are stitched together. So I will do my product design in Figma, and then I will submit the code change on GitHub, I will push the product out live on AWS, and then I will communicate with my team using Gmail and Slack and Zoom," he says. "We have all that technology now, but we don't yet have the 'digital knowledge worker operating system' to bring it all together." Dropbox wants to change that – last year, it unveiled its new collaboration platform that integrates cloud-based content with many of these apps.

Mediratta believes the tool that wins the race to become that go-to "operating system" will be the one that exhibits the

most compelling computational smarts. Dropbox is working on an array of ideas, in particular the ability to automate processes. Suppose you need to shepherd a legal document between teams for approval and signature – a digital assistant may be able to handle all that for you. Mediratta says the platform will also be able to use machine learning to offer new insights, since it can analyse data from disparate areas of a business, and suggest optimisations that free up valuable time.

Another problem with the current remote-work paradigm: Two-dimensional video meetings can't emulate the inherent virtues of a three-dimensional environment – but that's where virtual reality may come in. "In the real world we could have a creative session, where we can get up and draw stuff on the board," says Mediratta. "So I'm pretty much on

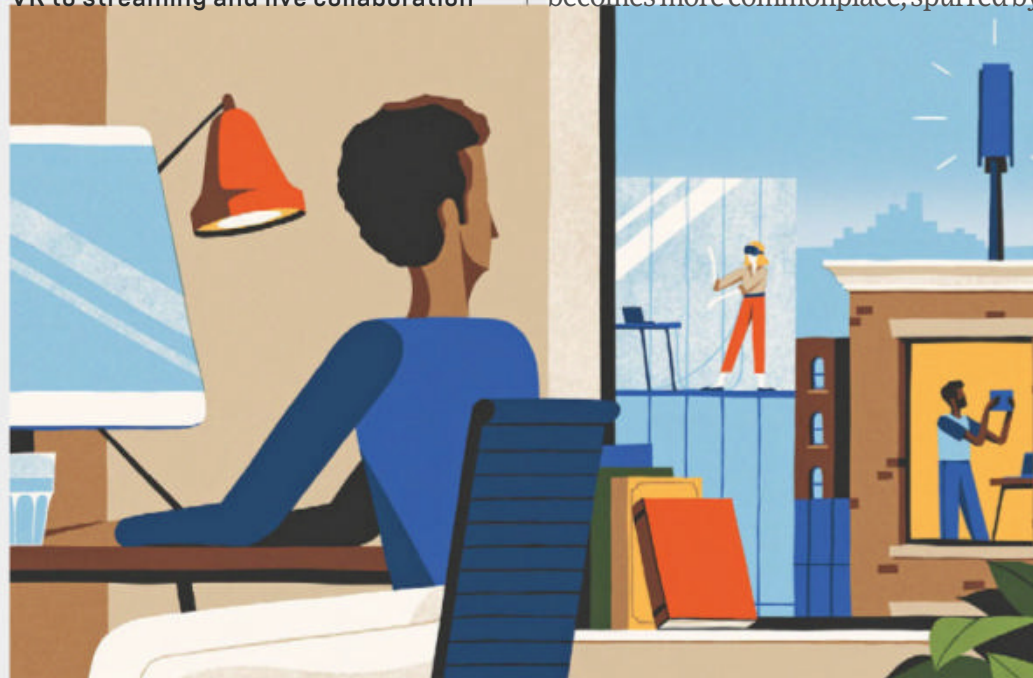
'Two-dimensional video meetings can't emulate the inherent values of a three-dimensional environment – that's where VR comes in'

the verge of just buying everyone a VR headset". Right now the technology is sub-par but, Mediratta believes, the more people feel this frustration, the more likely it will rapidly come of age.

Once it does, it will be possible to undertake even more forms of work remotely: if there's a robot beaming video to your VR headset, you can be telepresent from your home office. If you need to repair a part, perhaps you could work on a digital twin of that component, while the robot executes your actions in real time.

As these tools develop, they could prove transformative, as remote working becomes more commonplace, spurred by

Remote work will take many forms, from VR to streaming and live collaboration



software such as Dropbox's. A Stanford study that monitored staff at China's largest travel agency across a two-year period showed that the productivity boost from remote working is equivalent to almost one full working day per week. But beyond the business imperatives, there may also be social advantages. Analysts have suggested that a workforce open to telecommuting may be more inclusive, employing people from a greater diversity of regions and backgrounds, not to mention the positive effects for family cohesion and work-life balance.

And that's what truly matters: new technologies are never the end in themselves. After we make them, they make us.

## What is the future of distributed work?

Emerging technologies will transform remote working in the years to come, and Dropbox could unite them seamlessly





# Wonderful at work

**Tailored  
Workspaces  
for Forward  
Thinkers**

FORA

[foraspace.com](https://foraspace.com)



# Rethinking the office

Working from home has exposed the failings of soulless workplaces. Employees need creative spaces that actually work for human beings

# W

hen workers were sent home for lockdown, many started realising that they preferred not to undergo the lengthy commutes to sit in a dull, lifeless box all day – and a report by Cardiff and Southampton universities suggests that nine in ten would prefer to continue at home.

Enrico Sanna, co-founder of flexible workspace FORA, thinks this is because the average office isn't working for employees. "How people get excited working from home is a failure of the office," he says. "There is no reason why the office needs to be a dry, boring place."

However, working from home isn't a panacea: since the start of the pandemic, the proportion of people experiencing depression symptoms has risen from seven to 11 per cent, according to a global survey of almost 300,000 people by Kantar Health. Many workers report a lack of variety and feeling isolated, while a healthy work/life balance fades from view.

Quality, flexible coworking spaces can change the way the modern workplace functions, and address these concerns,

A change of scenery can spark creativity



and that's where FORA leads the field – every one of its buildings has been crafted to contain spaces that work for human beings. The hustle and bustle of the office can be energising, but sometimes you need something a little quieter – which is why FORA offices have reading rooms and soundproof phone booths. Some prefer working in a more casual spot: in FORA buildings you can perch in the Sun-filled atrium or station yourself in a spacious (and snack-filled) kitchen. The sheer variety of workspaces is something that home working can't compete with – not to mention the personal touch from a dedicated and friendly concierge team.

Companies such as Dropbox and Plaid have both taken advantage of FORA's coworking model. Those brands, and any company who works at FORA, get to attend events across the entire network of locations. FORA's philosophy in light of Covid-19 is to celebrate returning to work for those who are ready, but cater for those who aren't, so live streams of every event are available for those at home.

When the Covid crisis is over, we will emerge from our defensive business practices and want to grow again. The key to that is human interaction, innovation and productivity, created through the positive energy of creative masses clustered in compelling workplaces.

"When you ask our customers how they feel about coming back to FORA offices, they say 'we've missed it'," says Sanna. [foraspace.com](https://foraspace.com)

FORA offices include stocked kitchens and café-style meeting areas



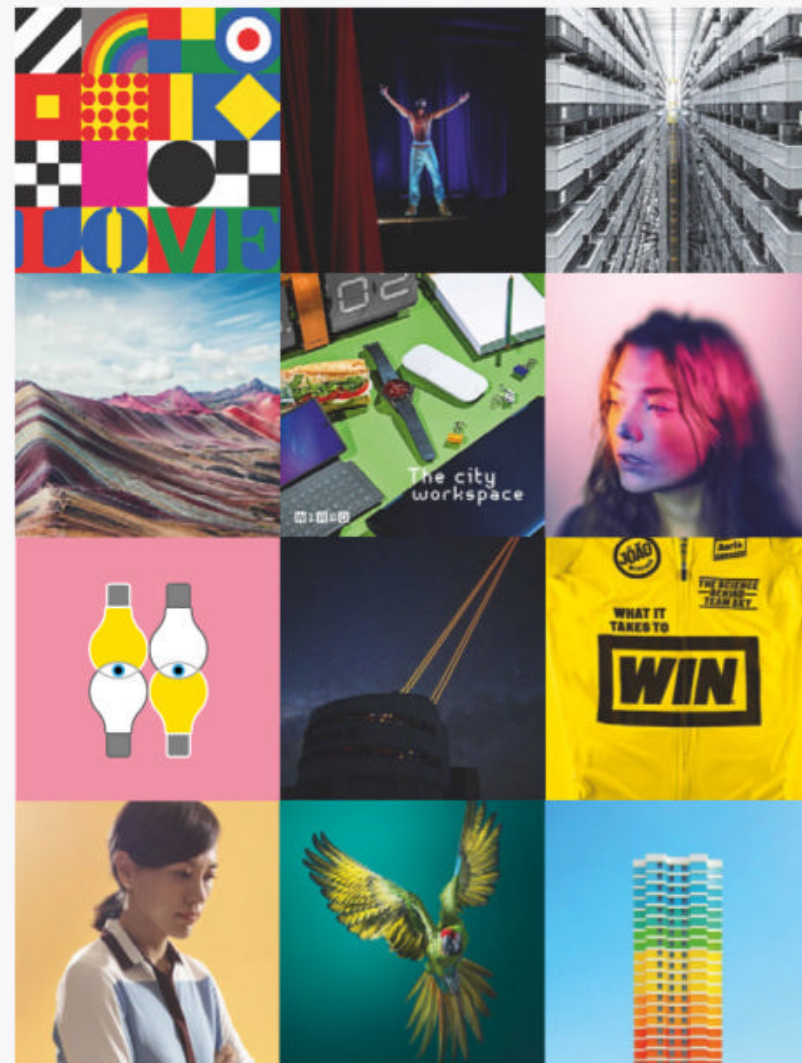


WIRED

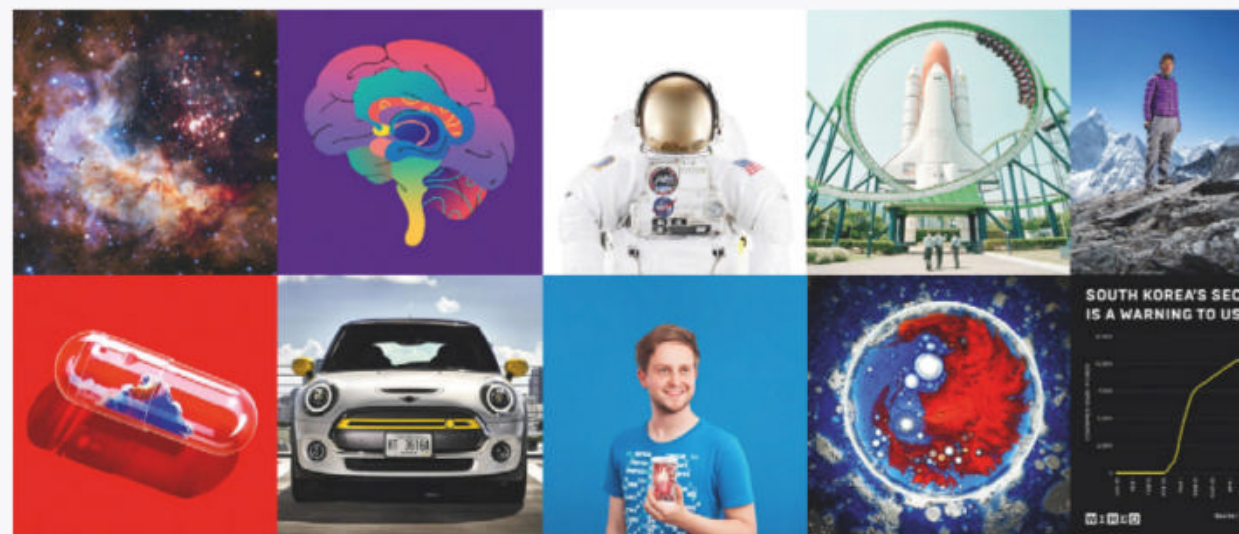
## Follow WIRED on Instagram

Daily updates from the WIRED Team

@wireduk



Insider access to WIRED stories



Amazing images from WIRED's world



The very best technology and lifestyle essentials in WIRED's world

# DESIRED

THE ANNUAL LUXURY EDIT  
2020 / 2021



## AUDI A8 L TFSI E

Audi bills its A8 L TFSI e hybrid as “part fuel, part electric, complete luxury” – the L means long wheelbase (basically, “limousine”). With heaps of room and individual seat-mounted tablets, this is a car in which to lounge. Your driver will appreciate the electric-only range of 46km, and Audi also cleverly keeps the A8’s 126bhp electric motor in a state of “permanent excitement” as it marries with a 335bhp 3.0-litre turbocharged V6 petrol engine. This means 0–100kph takes just 4.9 seconds, despite its size, up to an electronically limited 250kph. *From £88,195 [audi.co.uk](https://www.audi.co.uk)*





### TOADI

Toadi incorporates a 4K camera and AI smarts that can have it mowing perfect lawn stripes, trimming borders, leaving specific areas uncut, and even navigate around obstacles. The basic model can manage 0.6 acres and slopes of up to 35 per cent, while the Pro covers 1.2 acres on a 45 per cent angle. The company plans to 3D print each Toadi on demand at regional production facilities to cut global shipping. *From €2,170 [toadi.com](http://toadi.com)*



### JOHNNIE WALKER BLACK LABEL

Diageo attempts to push the drinks packaging industry forward with its first sustainably sourced pulp bottle for Johnnie Walker Black Label. The contents are protected by a liner made of resin rather than plastic, which keeps the tippie in tip-top condition, but disintegrates when finished. The cap, meanwhile, is made from aluminium, which can be popped in your recycle bin when finished with. *£tbc [diageo.com](http://diageo.com)*

### HERMÈS MEGA CHARIOT SCARF 100

If you were a robot in disguise, the finishing touch to your look should almost certainly include one of Daisuke Nomura's silk and cashmere Hermès scarves. Here, the Japanese textile and graphic designer depicts the Greek god Hermes stealing Apollo's Sun chariot, but giving it a Transformers twist that preserves the brand's equestrian cred – yet also propels it into the far-flung Manga-style future. *£620 [hermes.com](http://hermes.com)*



### LEAK STEREO 130

After 40 years away, this vintage masterpiece has been reborn for the streaming generation. The LEAK Stereo 130, 45W (RMS 8Ω) integrated amplifier features state-of-the-art circuitry that includes a moving magnet phono stage for your turntable, and optical and coaxial digital inputs for network streamers, CD players (like the neatly matching LEAK CDT), games consoles and TVs. *£799 [leak-hifi.co.uk](http://leak-hifi.co.uk)*

### BOUCHERON GOUTTE DE CIEL

Translated as "Drop of Sky", this large, tear-shaped pendant is made using aerogel, the advanced 99.8 per cent air and 0.2 per cent silica substance more typically found collecting space-dust samples on the side of Nasa craft. Two years in development, it's the closest you'll get to wearing a piece of sky around your neck, albeit captured inside a ring of diamond-paved rock crystal. *£tbc [uk.boucheron.com](http://uk.boucheron.com)*





DESIRED

### BANG & OLUFSEN BEOPLAY H95

---

Launched to celebrate 95 years of forward-thinking Danish audio design, the Beoplay H95s are perhaps Bang & Olufsen's most lavish headphones to date. The 40mm electro-dynamic titanium drivers and classic B&O tuning takes care of the sound profile, while the lambskin ear cushions and memory-foam inserts offer a sumptuous fit for serious long-haul use. £700 [bang-olufsen.com](http://bang-olufsen.com)

### FOCAL RADIANCE FOR BENTLEY

---

Focal's superb open-backed high-fidelity headphones in black and copper feature the subtle repeating diamond pattern found on Bentley's latest Bentayga. The sumptuous full-grain Pittards gloving leather, borrowed from Focal's £3,000 Stellia model, gives a luxuriously comfortable listen for an audiophile-quality aural experience in the car, the house or out and about. £1,199 [focal.com](http://focal.com)





Icons of luxury, such as Chanel fragrances, have long been targets for counterfeiters and fast-moving fakers. But anti-fraud technology can help consumers sift the real deals from the inferior copycats



# Thrown off the scent

How luxury perfume brands are tackling a counterfeiting boom. By Carly Page



**THE LUXURY PERFUME MARKET HAS** blossomed into a \$12 billion industry, but it's facing a fresh challenge: technology advances have meant that counterfeiters have taken to copying their famous scents in the form of "smell-alike" perfumes.

Smell-alikes are booming. Between 2017 and 2018, more than 2.2 million fake items, including perfumes, were seized in the UK, while the OECD estimates fake goods imported to the UK were worth £13.6bn in 2016, equivalent to three per cent of real imports, up from £9.3bn in 2013.

Phil Lewis, director general of the Anti-Counterfeiting Group explains that "the UK is one of Europe's most targeted countries for these insidious fakes, many of which contain dangerous toxins and stabilisers. Moreover, we lose over £400 million in revenue, which instead falls into the hands of international crime gangs who use the profits to foster other forms of illicit trade including people, drugs and weapons."

This hasn't been an easy battle for luxury perfume makers: fake scents are by their very nature much harder to identify than, say, a knock-off high-end handbag, but also due to the lack of copyright protection for fragrances in most countries.

European perfume manufacturers have been battling in court for protection of their scents for the past two decades. In 2006, L'Oréal brought an infringement suit against Bellure, a Belgian company, for producing smell-alikes of its Trésor, Miracle, Anaïs-Anaïs and Noa fragrances. The court held that this constituted infringement of the smells of L'Oréal's perfumes, and ordered Bellure to pay damages – but was overruled when this case was appealed to a higher court. The reasoning was that perfumes are manufactured through merely technical knowledge and are not expressions of the mind of the person who compiles perfume ingredients.

However, in 2008, L'Oréal's Lancôme subsidiary successfully provided that Dutch-based Kecofa had infringed on one of its fragrances by using gas-chromatic analysis – a chemical method for separating substances – to prove that the company's "smell-alike" product used 24 of its perfume's 26 ingredients. What is more, the court held that the Lancôme perfume could be subject to copyright protection because it is a fixed substance that gives off a fragrance that can be recognised by the senses, making it tangible enough to be regarded as a copyrightable work.

Just last year, Gucci – along with a number of other well-known luxury perfume makers – scored a similar victory after using the same technique against Spanish company Equivalenza. The ironically named outfit was found guilty on all three counts; illegal copying of original perfume, unfair competition and business reputation abuse.

Annabelle Gauberti, founding partner of London law firm for creative industries Crefovi, says that brands can fight fakers through distribution, but given the scale

of the problem and the transient nature of those operating counterfeit fragrance schemes, it's no easy task.

"Brand owners can ensure that they set up a distribution system whereby the bottles of perfume are only going to be sold in places that comply with certain criteria," she says. "So when you have some bottles of Tom Ford perfumes being sold at street markets, or online on places like eBay or Alibaba, [be they real or fake], they can take action."

LVMH – the company that owns numerous luxury brands from Louis Vuitton and Christian Dior to Fendi and Givenchy – has also turned to technology to help it fight counterfeit products. Besides hiring 60 lawyers and spending \$17 million annually on anti-counterfeiting legal action, it has also developed a blockchain tool called Aura, that uses Ethereum technology along with Microsoft's Azure services. Any person that buys an Aura-certified product will be able to see the full history of the item, ranging from its raw materials to where it was initially sold.

Luxury firms are also adopting measures such as RFID tags and holograms to enhance product security, and some are turning to terahertz spectroscopy that detects and controls properties of matter with electromagnetic fields. Still, technology is also advancing the prowess of plagiarists, with the internet in particular enabling a network of sophisticated counterfeiters that can adapt quickly.

However, counterfeiting is a battle the luxury sector is geared up to fight. Chanel tells WIRED it dedicates "considerable financial and human resources to this effort". But there remains quite the task ahead – total global trade in fakes is estimated at around \$4.5 trillion, and counterfeit luxury merchandise accounts for 60 to 70 per cent of that amount.



### KOENIGSEGG GEMERA

With its four seats (a first for Koenigsegg), hot and cold cup-holders, front- and rear-seat infotainment and wireless charging, this is perhaps the most preposterous family runabout available. The new Gemera hybrid sports 1,700bhp has the ability to go from 0-100kph in a blistering 1.9 seconds, and on up to 400kph. The three electric motors – one on each rear wheel, and one on the crankshaft – deliver 1,100bhp simultaneously. In just EV mode the Gemera will reach 300kph, with up to 50km of range. As for the combustion part, Koenigsegg has created the “Tiny Friendly Giant”, a three-cylinder, twin-turbo 2.0-litre “Freevalve” engine driving the front wheels, which is able to run on eco-friendly ethanol or CO<sub>2</sub>-neutral methanol (as well as petrol). Thankfully, safety is not an afterthought – there’s a carbon-fibre monocoque, six “smart” airbags, traction control, stability control, ABS and advanced driver-assistance systems. €1.7m [koenigsegg.com](http://koenigsegg.com)

Generating a massive 11,000 Nm of torque, the Gemera relies on its Michelin Pilot Sport 4S tyres to grip the road



DESIRED


The Scalpel features SRAM X01 12-speed gearing paired with Shimano XT 160/160mm hydraulic disc brakes



#### CANNONDALE SCALPEL CARBON LTD

Modern cross-country race bikes like the Scalpel whip uphill and carve the downs without the weight penalty of being built for a jump spot. The LTD features Cannondale's signature Lefty Ocho fork upfront (tuned to 100mm) and the brand's bleeding edge rear-suspension construction. The FlexPivot relies on the inherent flex in the carbon-fibre frame at the back of the "rear triangle" (where the back wheels bolt to the frame) instead of the usual two pivot points. It sounds geeky (and it is), but it saves weight (the Scalpel frame is a mere 1,900g), requires less maintenance (two fewer pivots to worry about) and gives the bike a taut, aggressive ride. £5,499 [cannondale.com](http://cannondale.com)





Each speaker stands 203 x 102 x 51cm tall, and its organic curves reduce the incidence of audio diffraction

### MAGICO M9

Standing two metres tall, the Magico M9 speakers are a totem to audio performance, boasting a cabinet made from carbon fibre with an aluminium honeycomb core that significantly reduces weight to 454kg apiece. The drive unit consists of a world's first 28mm beryllium-diamond dome tweeter, a 6-inch midrange driver, a pair of 11-inch mid-bass drivers and two 15-inch bass drivers. Supplied with the speakers is a Magico Analog Crossover (MXO) unit that handles the 120Hz crossover frequency between bass and mid-bass drivers, and a secondary separate crossover power supply. And to complete the set, you'll also need to budget for four monaural amps or two stereo power plants. £840,000 [magicoaudio.com](http://magicoaudio.com)



## DESIRED



### PAUL REED SMITH SE P20E GUITAR

The PRS SE P20E “parlour-sized” acoustic has an all-mahogany construction that lends it a warm, organic voice that’s bolder than the body size suggests. Finished with an ebony fretboard and bridge, bone nut and saddle, and PRD bird inlays, it’s a pro-grade instrument you’ll happily play for hours – and with a Fishman GT1 pickup system, it’s good for both studio and stage. £499 [prsguitars.com](http://prsguitars.com)



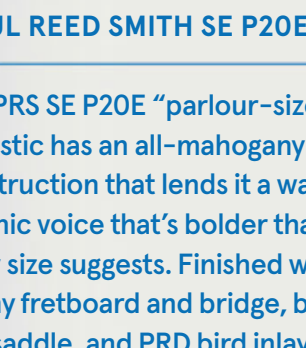
### PANTHEONE AUDIO I SPEAKER

This design from Australia-based Pantheon Audio is a sculptural speaker cast from resin and featuring audio from two 165mm bass drivers, two 100mm midrange drivers and four 19mm silk-dome tweeters, all driven by Class-D amplifiers. It’s inspired by the oculus opening in the Pantheon in Rome that fills it with light – here it’s the drive units that fill large spaces with 360° audio. €2,199 [pantheonaudio.com](http://pantheonaudio.com)



### DEVIALET PHANTOM CARRY CASE

The Phantom Reactor is a hefty mains-powered speaker and not specifically designed to be portable – but if you can’t bear to leave it at home (and they do sound stunning, so we can’t blame you), this bowling ball-style case features lightweight aluminium handles and a tough water-repellent exterior with a plush second-skin interior for maximum protection on weekends away. £169 [devialet.com](http://devialet.com)



### ROCKET ESPRESSO CINQUANTOTTO

Rocket Espresso’s machine has two boilers, so you can brew coffee and steam milk simultaneously, while a side-mounted touch display brings advanced control to this traditional design. Other functions include timed on/off and precise extraction of specific coffee types, as well as refined temperature adjustment to get the most flavour from your chosen roast. £2,270 [rocket-espresso.com](http://rocket-espresso.com)



### XIAOMI MI TV LUX

Minimalists, prepare to get excited. Xiaomi’s 55in transparent TV is a truly astonishing piece of design that conceals the processing units in its base stand, leaving the screen completely clear when turned off. The 5.7mm thick 10-bit panel can display 1.07 billion colours with 150,000:1 static contrast ratio, infinite dynamic contrast ratio, a 120Hz refresh rate, and Dolby Atmos support. RMB 49,999 (£5,500) [mi.com](http://mi.com)



### SEMPLI MONTI-TASTE SET

The four-glass Monti set from LA-based Semplici features three 340ml glasses for IPA, pilsner and birra (insert your favourite Italian lager here), and a larger 540ml pint-pot for when you’re thirsty. Details remain scant as to how the individual glasses enhance the flavour of your beer, but with effortlessly cool geometric shapes and generous weight to each design, for now we’re happy just to say “cheers”. \$100 [semplici.com](http://semplici.com)





### DIFFERENCE COFFEE PODS

The Difference approach to coffee is simple: they buy small amounts from the winners of the world's most prestigious coffee competitions and create Nespresso-compatible pods. Shown here is their Twumba Coffee, a 100 per cent Bourbon Arabica coffee that won the highest scores at the Cup of Excellence. It's so specialist, that only 1,200kg of this brew exists. £40.50 (box of 10) [differencecoffee.com](http://differencecoffee.com)



### MONCLER X MATE GENIUS EDITION

Moncler's high-end outerwear meets Mate's e-bike know-how to create a whip featuring a 1,000W motor that can give you a ride up to 50kph. The 48V battery is good for 112km on a single charge, and it's 4G-connected, meaning you can customise and track your bike from your phone. In the event of a theft, you can trigger Self Destruct Mode (SDM), which will render the Mate useless in an instant. £tbc [mate.bike](http://mate.bike)



### CAROLINA BUCCI FORTE BEADS

Originally available as a lavish pick'n'mix in her London boutique, you can now design your own bead necklace or bracelet via Carolina Bucci's Forte Bead Maker app. Choose from four precious metal cords and 18k gold tips, and then agonise over the positioning of a rainbow of precious hard-stone beads, from jade and lapis lazuli to rock crystal, turquoise, unakite, amethyst and more. Bracelet from £450 [carolinabucci.com](http://carolinabucci.com)



### DAMON HYPERSPORT PREMIER

This EV bike adapts to both city and open road – and not just because of the single-charge 320km motorway range and 480km in the city. It can transform between two riding positions, adjusting the seat, footpegs, windscreen and handlebars from upright to a tucked-in superbike setting. This version includes CoPilot, an AI-enhanced safety system – we challenge you not to re-christen it "Optimus". \$39,995 [damon.com](http://damon.com)

### SPIRAL CELLARS SOHO 1,200MM

If you're not lucky enough to own a stone-walled cellar, the Soho wine cabinet could be the next best thing for your prized vintages. Unlike so many wine cabinets that look like fridge freezers with padlocks, Spiral Cellars has created a beautiful and practical 99-bottle alternative that maintains exactly the right temperature and is impervious to harmful fluctuations. £12,360 [spiralcellars.co.uk](http://spiralcellars.co.uk)



### WINGBACK SET

This anodised black steel companion set from London-based design studio Wingback features a 100ml stainless steel hip flask with hidden bottle opener and knurled lid for easy opening; a practical metal key fob with matching knurling; and their signature 117mm-long machined steel ballpoint pen that features a metal mechanism that has been designed to be in service for generations. £377 [wingback.co.uk](http://wingback.co.uk)



DESIRED

### LOUIS XIII SMART DECANTER

The recipe has changed very little since 1874, and The LOUIS XIII remains arguably the finest cognac available, blended using up to 1,200 eaux-de-vie from Grande Champagne terroir, before ageing in centuries-old French oak casks. But this 70cl crystal connected decanter is moving with the times, and features a small NFC chip in the cork stopper that gives the owner access to the members-only LOUIS XIII Society, where they can enjoy exclusive content, experiences and a concierge service, which includes the ability to leave a custom message if you happen to be giving the bottle as a gift. £2,600 [louisxiii-cognac.com](http://louisxiii-cognac.com)

The classic LOUIS XIII crystal decanter is based on a 16th-century flask found on the Jarnac battle site in France







# The wine box



Cases of rare vintages line the shelves  
of the Unger Wine bunker, all in a controlled  
environment supervised by computers

DESIRED



**For aficionados with serious investment bottles, Unger Wine's high-tech Bavarian bunker has room for thousands upon thousands of the rarest vintages – all stored in perfect conditions**  
By Timothy Barber. Photography: Sam Chick





## WHEN THE UNGER WEINE STORAGE

cellar was being built in Frasdorf, a tiny village in the foothills of the Bavarian Alps, a local approached Michael Unger, the company's co-founder, and gazed at the vast hole being hewn out of the limestone and marble rock. This, he determined, must be something for the military: no one would spend eight months digging a hole like this just for wine.

Now, above ground stands a traditional Bavarian house. As well as the offices of a wine-trading business recognised as one of Europe's finest, it hosts tasting events and hospitality. "We get complimented on how well we've restored this old farmhouse," Unger says. "People don't realise that we built it from scratch."

People are also unaware that lying beneath, accessed by a single stairway, is a multitude of the rarest and most sought-after vintages on Earth – the kinds that justify

a computer-controlled climate ensuring temperature, humidity and even vibrations (or a lack of) are managed to the finest degree.

Of course, you can't just pop by to collect a bottle: "We store everything by the case, we deliver by the case and we even do the logistics underground to ensure as little disturbance as possible," Unger says. "If someone goes into the cellar, it changes the humidity, light and temperature too much."

A chip-coded key access system records every door opening and closing, who used it and how long they spent inside – crucial for minimising disruption to the wine, but also for its extreme security.

From walls of cases of hard-to-get Premier Cru blockbusters to cult spectaculars like California's Screaming Eagle (upwards of \$3,000 a bottle), Unger Wine's in-house portfolio is a who's who of the desirable, the unobtainable and the untouchable. And it shares the cellar's 5,000 square metres with private collections from clients across Europe and, increasingly, from around the world. Some have as many as 500 cases stored, which may stay for decades, if not generations.

"Most people call their cellars 'cellars', but they're not a cellar," says Unger, a former engineer in the luxury car industry, who founded the wine-importation business with his brother Wulf, an economics PhD, 30 years ago. In 2007, they opened a storage facility for their stock, but the subsequent boom in investment

buying, and demands from private customers for extra storage space, convinced the brothers to go further.

"We said: let's build something, but it has to be a benchmark," Unger says. Construction took four years, with "Der Keller" opening in 2015.

Unger points out that many of Europe's old chateaus and mansions have cellars packed with wine, but without temperature and humidity controls. "And of course, temperature has changed compared to 50 years ago. Room temperature for wine is different now."

For wine storage, climate is everything: if humidity is too low, or the temperature too high, evaporation through the cork or oxidation from air seepage can cause the ruination of a fine vintage. "The delta between inside and outside the bottle should be as small as possible," says Unger, who aims to maintain humidity at 70 per cent and the air temperature at 10–15°C.

To do that in his Bavarian bunker, a complex suite of heating, cooling and air-filtration systems is managed via bespoke computer software. At its heart, a combination of geothermal heat exchange from the groundwater, topped up with heating from locally sourced wood pellets, runs through a radiation-based system embedded in the floors and ceilings that can be precisely managed up and down, while an air-cooling system designed for hospital isolation wards is used to constantly filter the airflow.

"We use the aircon as a backup system," says Unger. "We try to use the [geothermal] system more, but that's a very complex mix for any engineer to deal with. My technical background helped a lot."

In August, torrential summer storms resulted in power lines being cut – a potentially devastating situation which was an ideal stress test for Unger Wine's back-up plan. "When the electricity goes off, it goes on a battery system to give the generator 20 seconds to power up. We only knew about the outage because the phone lines went."

Unger is effectively an asset manager, with millions under management, in a sector that is maturing nicely. "Interest rates have stayed so low, and investments are getting more and more risky and unprofitable. Why shouldn't you pay to keep an investment that you can sometimes consume and enjoy?"



Michael Unger ascends the main cellar staircase. Designed by architect Peter Höflinger, it's 12 metres deep



## DESIRED

LED lights lead the way to the Unger Weine Der Keller, the private vault where customers store their prize vintage wines



Unger Weine's in-house portfolio is a who's who of the desirable, the unobtainable and the untouchable. And it shares the cellar's 5,000 square metres with private collections from clients around the world



Above: Michael and Wulf Unger in the delivery receiving area.  
Left: Michael Unger authenticates a bottle of Château Lafite Rothschild





### FABITA CUCINOTTA KITCHENETTE

Packing the kitchen essentials into less than half a square metre, this mini rig includes a 3,600W induction hob, plus a dedicated zone for wirelessly charging your phone. The “eye” is a lacquered extractor hood with ceramic filters, while the drawer has just enough room, we imagine, for a knife, fork, spoon and a plate. With a frame in solid ash, this micro kitchen is designed to be moved around as needed. €3,950 [fabita.it](http://fabita.it)



### ZERO LABS LAND ROVER SERIES III

Zero Labs is taking a 1971–1985 Land Rover Series III and building it again, adding your choice of either an 85 or 100kWh battery that will get you to 380km of range, 300HP and 330Nm torque. The body panels are remade from aluminium alloy, the braking system offers 90kW regeneration – and you can also go full Californian sacrilege by installing the soft-top option with a surfboard rack. \$185,000 [zerolabs.com](http://zerolabs.com)



### MATERIAL IMMATERIAL THE FACTORY

An alternative to the pendulum cradle executive desk-toy of the 80s – but with added oneupmanship – The Factory is a meticulously crafted miniature Brutalist sculpture made from 3kg of solid concrete. Measuring 20cm at its widest point, it features tiny 4mm steel balls that zip along the cast grooves and openings, rolling inside, spinning around before exiting at the bottom. €250.43 [materialimmaterial.com](http://materialimmaterial.com)



### TECHNICS SL-1210GAE

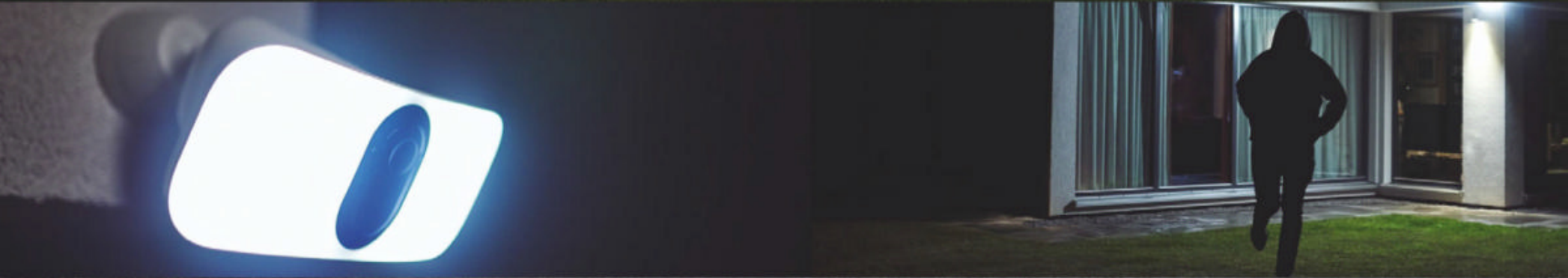
Marking the iconic turntable’s 55th anniversary, this limited-edition direct-drive design was restricted to 1,000 units, but sold out almost instantly, and so a rather appropriate 210 more were produced. This Japanese-made turntable is a stone-cold club classic with an anodised black 10mm-thick aluminium top panel and matching tone arm, and specially tuned Nagaoka MM cartridge. £3,999 [technics.com](http://technics.com)



### LINN SERIES 3 SPEAKER

Perhaps the very finest all-in-one speaker to date, the Series 3 is not only stylish, but it squeezes in Alexa, Google Assistant and direct streaming support for Spotify, Apple Music, Amazon Music and Google Music. Linn’s latest even makes the most of every digital file type up to a resolution of 24bit/192kHz, and anything below that still gets upsampled to 192kHz. Must be heard to be believed. £2,500 [linn.co.uk](http://linn.co.uk)





# World's first **wire-free** floodlight security camera

## A powerful shield of light for your property

Connect and control via your smartphone. Instantly illuminate and film up to 7m of your property when motion is detected.



7M Light-Projection

**2K**

2K Video with HDR



Motion Detection



Colour Night Vision



160° Viewing Angle



Built-In Smart Siren

From Europe's **number 1** surveillance camera brand.  
Available now. More information at [www.arlo.com](http://www.arlo.com)



Connect • Prevent • Protect



A

**gtech entrepreneur Sky Kurtz is on** a mission to feed the world. But that's a mission, he points out, that is growing more challenging every day.

"Existing farming will not be able to meet the needs of the future," the founder and CEO of Abu Dhabi-based Pure Harvest Smart Farms explains. "By 2050 there will be 9.5bn people on the planet, so we'll need to increase food production by 70 per cent."

While the challenge is global, for Kurtz, the solution is local. Pure Harvest uses climate-controlled hydroponic greenhouses to bring locally-grown produce to water-scarce regions – an approach they are pioneering in the deserts of Abu Dhabi.

"We are leveraging the abundant resources that this emirate has to farm," he says. "We have an abundance of land and most importantly we have an abundance of light – and we are able to translate that light into incredible production."

That combination of year-round sunlight and water conservation technologies has enabled Pure Harvest Smart Farms to grow 500 tonnes of tomatoes per year in their one-hectare greenhouse, using eight times less water than traditional methods.

#### **Local networks with global connections**

Pure Harvest now distributes its products through local supermarket chains, including Carrefour, Spinneys and Waitrose, as well as restaurants and hotels. Building on this success, they are working to expand their facility to ten hectares over the next year, with plans for further greenhouses in Kuwait and Saudi Arabia.

"This country alone is a multi-billion-dollar food import market," said Kurtz. "And that expands even further when you consider opportunities across the region."

Not just a large market, but one that's fast-growing too. The population of the UAE is forecast to increase from 9.4 million to 11.5 million, as the second-largest economy in the Gulf region continues to expand. That economic growth has seen extensive infrastructural investments to match, bringing the UAE up to twelfth in the world for quality of infrastructure in the 2019 Global Competitiveness Report.

Many of Abu Dhabi's infrastructure links converge in Khalifa Industrial Zone



# Global solutions take root in Abu Dhabi

Abu Dhabi's deserts are blooming, thanks to agtech pioneers taking advantage of an environment that nurtures both nature and business

[KIZAD], one of the emirate's five business free zones, which opened in 2012. A direct connection to the deep-water Khalifa Port provides KIZAD with access to shipping lines reaching over 60 international ports, while four international airports in close proximity to KIZAD place 80 per cent of the world's population within an eight-hour plane journey.

That capacity for rapid distribution of high-volume commodities attracted Abdulaziz AlMulla, CEO and co-founder of Madar Farms, to KIZAD as a staging post for his company to build the world's first commercial-scale indoor farm.

"Khalifa Industrial Zone is the ideal location for the new farm," he says, "Situated between Dubai and Abu Dhabi, we'll be able to transport our daily harvests to each emirate in hours, rather than days"

#### **Nurturing desert agriculture**

Madar Farms' vertical farm will take advantage of the emirate's low energy costs to grow tomatoes and microgreens solely through LED lighting calibrated to each plant's requirements. The 5,000m<sup>2</sup> facility is being built with the support of Abu Dhabi Investment Office (ADIO), as part of a \$272 million package of cash

Above: Pure Harvest Smart Farms' prototype greenhouse uses hydroponics and Abu Dhabi's sunlight to deliver bumper crops





and non-cash incentives to help grow the emirate's flourishing agtech ecosystem.

Dedicated to the development of sustainable agriculture in desert environments, ADIO's incentive programme focuses on developing solutions in desert agriculture, in high-potential areas such as algae-based biofuels, indoor farming, precision agriculture and ag-robotics.

Including Madar Farms, ADIO has so far partnered with four companies from across the world to establish new production and research and development facilities in Abu Dhabi. Among them is Florida-based Responsive Drip Irrigation [RDI], which will be taking advantage of the incentives to develop an innovative irrigation system to transform water usage in UAE agriculture and conduct research trials to increase crop yields in sandy soils and non-arable land.

"Without ADIO's assistance, RDI's ongoing R&D and global product launch would be hindered," explained the company's CEO and founder, Jan Gould. "Due to the agtech incentive programme, the timescale for the entry

## WIRED x Abu Dhabi Find Wonder

of RDI's advanced technology to market will be significantly shortened."

Abu Dhabi's support for agtech is part of a long-term strategy to drive innovation in the emirate that will benefit the region and beyond. The government has doubled down on investments in technology across high productivity sectors including edtech, healthtech and fintech.

In addition to access to government incentives, foreign-owned companies moving into Abu Dhabi also benefit from a regulatory structure tailor-made to support multinational economic activity.

KIZAD, alongside the emirate's four other business free zones, allows for 100 per cent foreign ownership of resident companies, along with full repatriation of capital & profits, zero personal or corporate tax, and zero tariffs on imports and exports between the free zone and other nations. Meanwhile, a streamlined licensing system and a growing number of incubators and accelerators are helping to strengthen Abu Dhabi's startup ecosystem.

This combination of an international outlook and a supportive regulatory environment was crucial to Kurtz, who relocated from San Francisco in order to set up Pure Harvest in Abu Dhabi.

"Instead of feeling like you're fighting the government to get something done,

**Abu Dhabi's support  
for agtech is part  
of a broader, long-  
term strategy to drive  
innovation in the emirate  
that will benefit  
the region and beyond**

you instead feel like the government is fighting for you," he said. "You have a supportive and visionary leadership that wants to feed this and see it happen."

As more entrepreneurs seize the opportunities that Abu Dhabi offers, Kurtz sees the growth of an innovation culture that is giving startups with the potential for real impact the best chance to succeed.

"It's an exciting time to be an entrepreneur here," he says. "You feel a sense of what I imagine it felt like in the early days of Silicon Valley. You have an incredible supportive and vibrant ecosystem of young entrepreneurs aspiring to do big things. This is the kind of thing that rings the bell at the beginning of a movement."









# WIRED insider

Swedish lifestyle brand Byredo is upping its genderless ante with a new makeup line that's multi-purpose and multi-person. Offering a core of ultra-reliables, from versatile colour sticks to eye shadows and liner, the aim is to inspire, not impose, and create a palette that works for all, in any setting. A concept by Byredo founder Ben Gorham and makeup maverick Isamaya Ffrench, it's sure to turn heads.

Two years in the making, Byredo's makeup collection in collaboration with Isamaya Ffrench champions a more inclusive approach to beauty



*Left:* Colour Stick, £26 (out now).

*Right:* 5-Colour Eye shadow, £56 (out November) [byredo.com](http://byredo.com)

## The Colour Stick

The hero of the collection, the multi-purpose Colour Stick epitomises the aspiration to depart from prescriptive beauty. Offering two finishes (creamy and dewy) in 16 shades, Colour Sticks can be applied anywhere – from eyelids and forehead to cheek and lips. Wearable tones such as Flower Play (dusky pink) and Vienna (warm sand) team up with bold tones like Kinda Blue (dark teal) and Purple Stinger (deep violet) to give looks endless possibilities and autonomy.

## Objects of beauty

Instantly unconventional, there is a symbiotic relationship between the Byredo makeup ethos and its packaging. Distancing itself from the disposable, even throwaway nature of the cosmetics industry, the range adopts a considered approach to its physical aspect. The 5-Colour Eye Shadow is an exemplar of this thinking, resembling an abstract sculpture that is tactile and weighty. These products assert their presence as something to be contemplated and desired, not merely consumed.



# WIRED

## ONE YEAR ALL ACCESS

# PRINT + DIGITAL



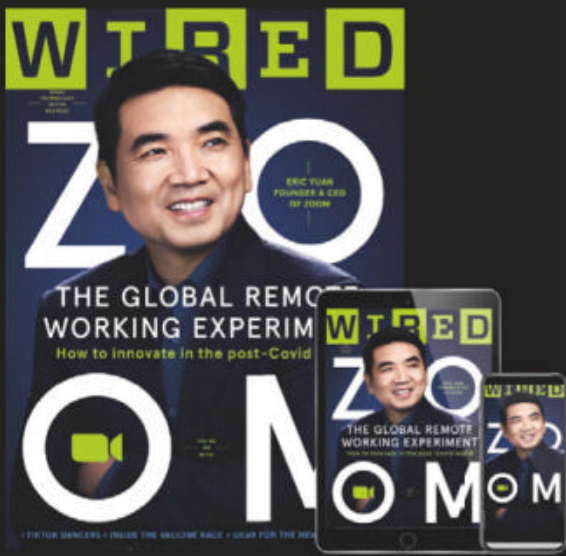
# ALL FOR ONLY £19\*

FREE INSTANT ACCESS TO THE DIGITAL EDITIONS.  
ALL YOU NEED IS YOUR SUBSCRIPTION NUMBER.

\*LIMITED TO UK ADDRESSES. FOR OVERSEAS ALL ACCESS ONE  
YEAR SUBSCRIPTION THE RATE IS £48 TO EUROPE OR US  
OR £58 TO REST OF WORLD. OFFER CLOSES ON 03/12/2020

[WIRED.CO.UK/SUBS/CWR19644](https://www.wired.co.uk/subs/cwr19644)  
0844 848 5202 REF: CWR19644





09.20 ZOOM – THE GLOBAL REMOTE WORKING EXPERIENCE



07.20 MONZO – CAN TOM BLOMFIELD'S UK FINTECH CHAMPION BREAK AMERICA?



05.20 ALL CHANGE AT APPLE – CAN THE TRILLION DOLLAR GIANT SURVIVE?



03.19 HOW TO BUILD A WINNING STARTUP – ADVICE FROM EMILY WEISS, FOUNDER OF GLOSSIER



01.20 MARK ZUCKERBERG – WOULD YOU TRUST THIS MAN WITH YOUR MONEY?



11.19 GOOGLE STADIA – THE BATTLE FOR THE FUTURE OF ENTERTAINMENT



09.19 DEEPMIND – DEMIS HASSABIS ON HOW AI WILL SAVE HUMANITY



07.19 GRETA THUNBERG – INSIDE THE TEENAGE ACTIVIST REBELLION



05.19 BLACK MIRROR – THE SECRETS OF THE SMARTEST SHOW ON NETFLIX



03.19 SOFTBANK – INSIDE THE COMPANY THAT CONTROLS GLOBAL TECH



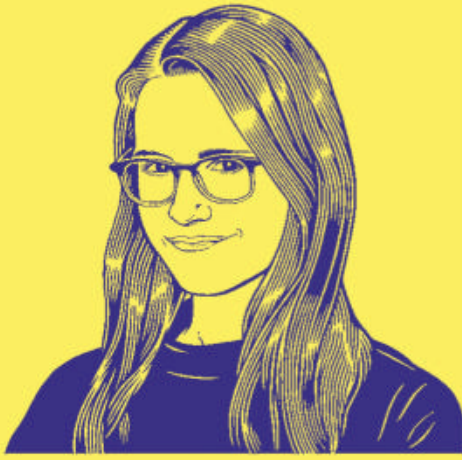
01.19 FASHION GOES TECH – THE FUTURE OF RETAIL



11.18 STRIPE – THE \$9.2 BILLION STARTUP DRIVING APPLE, AMAZON AND FACEBOOK



# WIRED Podcast



*Vicki*



*James*



*Amit*



*Matt B*



*Natasha*



*Matt R*

## The Future Explained

WIRED's weekly analysis of the biggest stories in technology, science, business and ideas

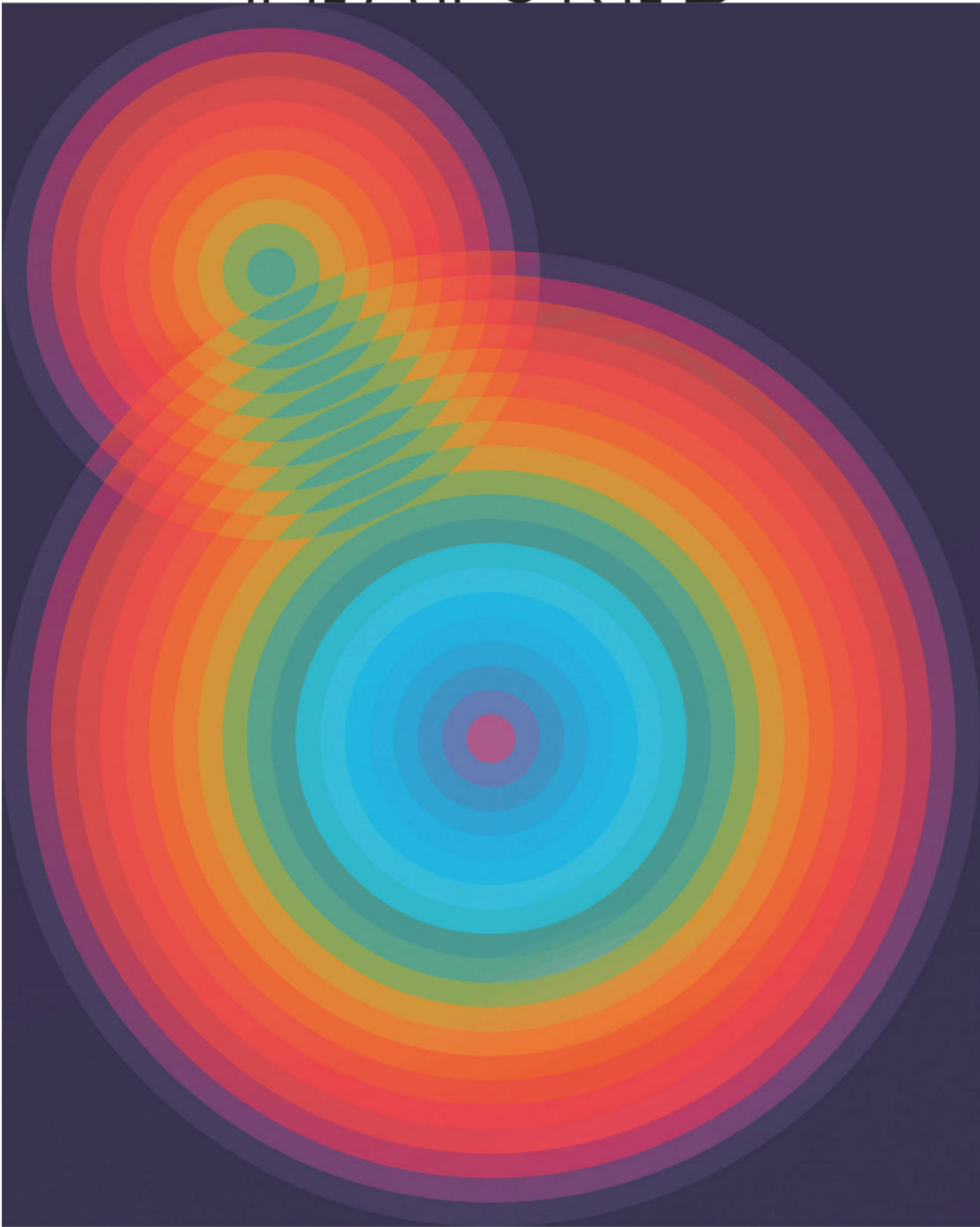
### The WIRED Podcast

Available on Apple Podcasts,  
Spotify or wherever  
else you get your podcasts



FEATURES

ILLUSTRATION: ANDY GILMORE. DESIGNED AS A GRAPHIC REPRESENTATION OF THE NUMERALS OF THE DATE, RENDERED IN CONCENTRIC KALEIDOSCOPIC CIRCLES



“TikTok terrifies me. I’d place it on a par with Huawei.” Anonymous Capitol Hill researcher p82



By James Crabtree  
Illustration: Mike McQuade

## The last dance

TikTok was conquering the world, until it became the victim of a new Cold War between China and Donald Trump, who wants it bought out – or shut down







1





video app, which was facing a maelstrom of accusations over its ties to China, owing to its Chinese parent company ByteDance. In an open letter, Mayer said that TikTok was committed to transparency and accountability, and painted the app as a boon to US competition at a time of growing focus on the monopoly powers of companies like Facebook. “TikTok has become the latest target, but we are not the enemy,” he wrote.

Washington wasn’t buying it. For the best part of a year, a growing band of political China hawks had agitated against TikTok, raising questions about the data it held on its 100 million monthly active users in the US. Senator Marco Rubio, one major critic, told WIRED that TikTok’s close ties to ByteDance open the door to China’s security state. “TikTok could allow the Chinese Communist Party access to millions of Americans’ information, including IP addresses, browsing history and more,” he says. (TikTok says that the data it collects is industry standard, and that it has never shared user data with the Chinese government, nor would it.)

Then there were the politics. Trump had spent much of his presidency attacking Huawei, hitting the Chinese telecoms equipment maker with repeated restrictions and pushing other countries to ban it from 5G networks. But as that crusade ran its course, and facing a re-election battle, TikTok offered a new way for Trump to showcase his tough line on China by attacking perhaps the only truly global consumer technology brand yet built by a Chinese company.

After touching down in Washington, Trump signed an executive order that gave ByteDance 45 days to hash out a deal to sell its US operations to an American company. In the days that followed, the US president also pressed forward with new measures cracking down on other tech groups linked to China, including an executive order banning the popular Chinese messaging app WeChat, while dropping hints that others like Alibaba were also in his sights.

Whether a deal ultimately happens or falls apart, the battle over TikTok provides a moment of clarity for the future of Sino-American relations at a time of rapid, disorderly technological decoupling, posing two important questions. How exactly did Generation Z’s

favourite jocular videos app come to spook Washington’s anti-Chinese security establishment? And what do TikTok’s travails tell us about the future of a global technology ecosystem dominated by giant American and Chinese companies, as it suddenly splinters into two?

At one level, TikTok faces narrow accusations about privacy and data, and whether its users’ information is at risk of being transferred to China. Regardless to what extent that security argument holds water (and many expert analysts have their doubts), the company also

**Donald Trump was in no mood to compromise.** “As far as TikTok is concerned, we’re banning them from the United States,” he told a gaggle of reporters huddled in an aisle on *Air Force One* on a Friday evening in late July. Trump seemed impatient as he headed back to Washington after a day of fundraising in Florida, straining to act against a company he claimed was a grave national security threat. When would a ban happen, one journalist asked? “Essentially immediately,” he shot back. “I will sign the document tomorrow.”

Trump’s announcement capped a tough week for TikTok. A few days earlier, the company’s recently-appointed American chief executive Kevin Mayer had launched a forceful public defence of the short-

makes an ideal new front in a far wider battle, in which the US’s techno-nationalists view China and its internet giants as both a technological and civilisational threat, and aim to make dramatically curbing their powers a central front in a bubbling new Cold War. As they do so, the main casualty may not just be the international plans of apps like TikTok or companies like ByteDance, but the dream of an open global internet itself.

Above: from location to messages, photographs, contacts and posts, Chinese apps are notorious for reporting back to authorities



**The idea that the United States might** ban TikTok first took hold not in Washington, but in New Delhi. In June, 20 Indian soldiers died high in the Himalayan mountains after a series of bloody border skirmishes with Chinese forces. Scouting around for a way to respond, Prime Minister Narendra Modi alighted on his country's growing dependence on Chinese consumer technology and signed an order banning TikTok and 58 other China-linked apps, citing threats to national security. The move brought a handful of minor protests from the app's

ByteDance merged Musical.ly into two short-video apps: Douyin, for users in China, and TikTok, for those outside of China, including the US. (TikTok still does not operate in China).

Over the next two years TikTok went on a tear, attracting tens of millions of American teens and spawning a culture of youthful, YouTube-style influencers to entertain them. The app was seamless and fiendishly addictive, leaving users scrolling for hours. “ByteDance and TikTok are just great at product development on mobile,” says Jeffrey Towson,

a professor at Peking University in Beijing. “If you are looking at the epicentre of mobile app innovation, it’s China and companies like ByteDance. They make Silicon Valley look lethargic.”

Aggressive marketing helped ByteDance's US push, as the company funnelled in cash from its lucrative Chinese operations. By the start of 2020 it had built arguably the first social media app with a shot at threatening Facebook and Instagram – and done so partly by advertising on Facebook's own platforms. But most important of all was TikTok's technology. Rather than the social connections underpinning its rivals, the app is powered by relentless algorithmic logic. Any user is free to record their own stuff, but the vast majority of what they see comes via the algorithm, which churns out a moreish diet of

**'TikTok could allow the Chinese Communist Party access to millions of American's information, including IP addresses, browsing history and more'**

conservative places like Turkey it got into trouble for transgressing moral codes. Liberal countries like the US accused it of being excessively censorious.

Then a new problem emerged: China. Content moderation guidelines leaked to *The Guardian* newspaper suggested the app had hidden videos on topics that transgressed Chinese censorship rules, from the Tiananmen Square massacre to Tibet. (TikTok says it has since changed its moderation guidelines, and that it does not moderate content based on political sensitivities.) In November 2019, Feroza Aziz, a 17-year-old American, won fleeting fame with a seemingly innocuous TikTok makeup tutorial that cleverly morphed into a monologue about China's Uighur internment camps in Xinjiang – only to find her profile temporarily blocked, albeit in what TikTok said was for an unrelated breach of its rules.

Concerns over TikTok partly reflected a longer-term geopolitical shift dating back to before Trump arrived in the White House, as US policymakers abandoned the hope that Chinese economic development would bring political liberalisation and began to view Beijing as a threat. Well before Huawei hit the front pages, US anxiety about China had a strong technological dimension, as analysts blamed China for cyberattacks against US targets, most prominently the government Office of Personnel Management in 2015 and Equifax, a credit reporting agency, in 2017.

Once it began to take shape, the case against TikTok moved with astonishing speed. Formally, the US Treasury began an investigation in October 2019, examining whether ByteDance's Musical.ly deal should be unwound, on the technicality that neither party had told it of national security issues at the time the deal was made. Zhang tried

120 million monthly active Indian users, but came at little political cost. Washington's China hawks took notice.

Before the ban, India was TikTok's largest market by users, but the US remained its most important, given its reliance on advertising from large American companies. TikTok originally launched in 2017, but really took off after ByteDance acquired Musical.ly, a US-based social media app popular with lip-syncing American teenagers, in 2018. Back then, ByteDance was a minor player in China's burgeoning internet scene with just one hit product: Toutiao, a social news aggregator. But following Alibaba and Tencent, the company already had its sights set abroad.

singing, dancing, slapstick comedy and teenage in-jokes digitally tailored to grip viewers whether they happen to be in New York or New Delhi.

TikTok views itself as a happy corner of the internet, without the bile of Twitter or scandals of Facebook; a place where “hundreds of millions of people come for entertainment and connection, bringing joy,” as Zhang Yiming, ByteDance’s 37-year old founder, wrote in a recent letter to his staff. But it attracted its fair share of controversy from the start, too, much of it linked to its youthful audience. In 2019, US regulators fined it for failing to protect the privacy of users under 13. There were minor scandals about adult video stars and sexual predators. In

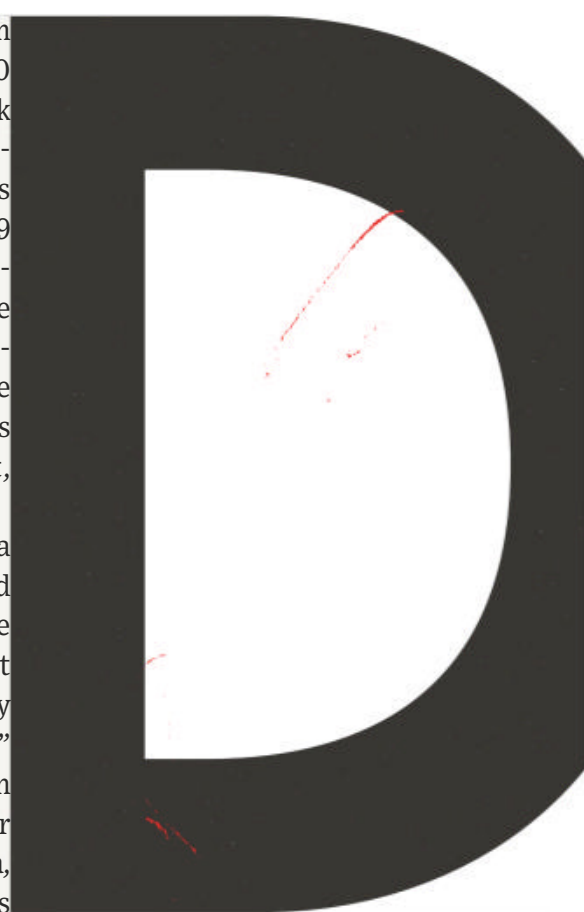


to answer critics, hiring Mayer from Disney to become CEO in early 2020 and promising to ringfence the TikTok app from ByteDance to deflect allegations of Chinese interference. But as the year progressed, and the Covid-19 pandemic brought a further deterioration in US-China ties, the ByteDance founder also began frantic behind-the-scenes discussions for an emergency sale of its US operations, conducting talks with companies including Microsoft, Walmart, Oracle and Twitter.

Although little-known outside of China prior to TikTok's difficulties, Zhang had won admirers at home for his aggressive instincts and informal management style. "[ByteDance is] an incredibly dynamic and tough environment," says author and China analyst Duncan Clark. "Zhang doesn't suffer fools or mediocrity." Although educated in China, he modelled himself on US tech titans like Mark Zuckerberg and Jeff Bezos. "He speaks in halting English – he brought an interpreter with him and was very apologetic about it," one early international employee recalls of meeting him for dinner in Beijing. "But he was humble, and asked lots of questions. He is an engineer at heart." Where employees at other Chinese companies often refer to one another formally by title, Zhang insists on first names.

Nor was Zhang an obvious Chinese regime loyalist: in a recent interview in *The Atlantic* he told the reporter he was not a Communist party member. As Zhang worked to save TikTok, he certainly attracted ire from both sides: barracked on Chinese social media for failing to stand up to American bullying and assailed in Washington as a pawn of Beijing. In early July, US Secretary of State Mike Pompeo was asked if Americans should download the TikTok app. "Only if you want your private information in the hands of the Chinese Communist Party," he replied. Not long after, Trump's re-election campaign began running adverts pushing a petition to ban the app, saying simply: "TIKTOK IS SPYING ON YOU".

**'TikTok terrifies me. I'd place it on a par with Huawei. It's obvious to me what ByteDance would do if the Ministry of State Security comes knocking'**



**ata problems are one of two big** accusations levelled against the app. "TikTok automatically captures vast swaths of information," Trump's executive order claims, "potentially allowing China to track the locations of Federal employees and contractors, build dossiers of personal information for blackmail, and conduct corporate espionage."

Critics suggest data, such as location details and records of the people who appear in videos, could be shared first with ByteDance, and then Chinese authorities. ByteDance and TikTok deny this. "There is a lot of misinformation about TikTok out there, but these are the facts: the TikTok app does not operate in China," a TikTok spokesperson told WIRED. "TikTok user data is stored in the US and Singapore, with strict controls on employee access. We have never provided user data to the Chinese government, nor would we do so if asked, and we do not moderate content based on political sensitivities. Claims to the contrary of these facts are false."

Even so, TikTok has never been able to shake the suspicion that it could be forced to hand over data. Although the app operates only outside China, its development was closely linked to its Chinese parent, with its algorithm developed by teams of software engineers in Beijing or Shanghai. In 2018, Zhang Yiming was forced to issue a public apology when one of his Chinese apps was found to have offended state officials. "Technology must be guided by core socialist values," he wrote in a public letter of self-criticism.

Most important of all is China's 2017 National Security Law, which requires any Chinese company to "assist and co-operate with the state intelligence work". Critics suggest this means TikTok data could in theory be commandeered to

target US citizens, and potentially even combined with other clandestine information allegedly taken by Chinese authorities, such as that gleaned from the Office of Public Management hack. "As I see the cyber warfare landscape, America's concern is a valid concern," says Oded Vanunu, an Israeli cybersecurity expert who has studied TikTok's data policies.

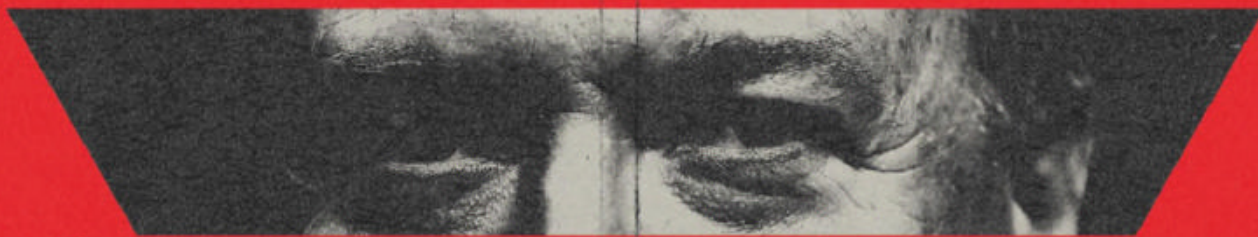
Similar worries lay behind the US government's decision to reverse the sale of gay dating app Grindr to a Chinese gaming company in 2019 – namely that data on sexuality or compromising pictures could be used by Chinese spies to blackmail Americans. Even the possibility of something similar provides grounds to act, one anonymous Capitol Hill researcher working on TikTok tells WIRED. "Frankly, TikTok terrifies me. I would definitely place it on par with Huawei," they say. "It's obvious to me what this company [ByteDance] is going to do if the Ministry of State Security comes knocking."

A second major concern levelled at TikTok is Chinese political interference. In June, President Trump endured public humiliation at a post-Covid comeback rally in Tulsa, Oklahoma, speaking to a half-empty stadium when his campaign expected a packed house. It emerged that thousands of liberal-minded internet users demanded tickets with no intention of showing up, many organising using TikTok videos. Trump's embarrassment alarmed TikTok critics, inviting other scenarios where the platform could be manipulated in the run-up to an election. "TikTok could give the CCP the capability to do all sorts of fine-grained targeting, at a level Russia in 2016 could not have dreamt of," the Congressional researcher says, referring to theoretical potential political interference scenarios in which TikTok could be forced to hand over data on particular groups of users, and potentially to target messages at those users as well – but there is no evidence that TikTok or ByteDance have done this or been asked to do so, which Zhang also told *The Atlantic*.

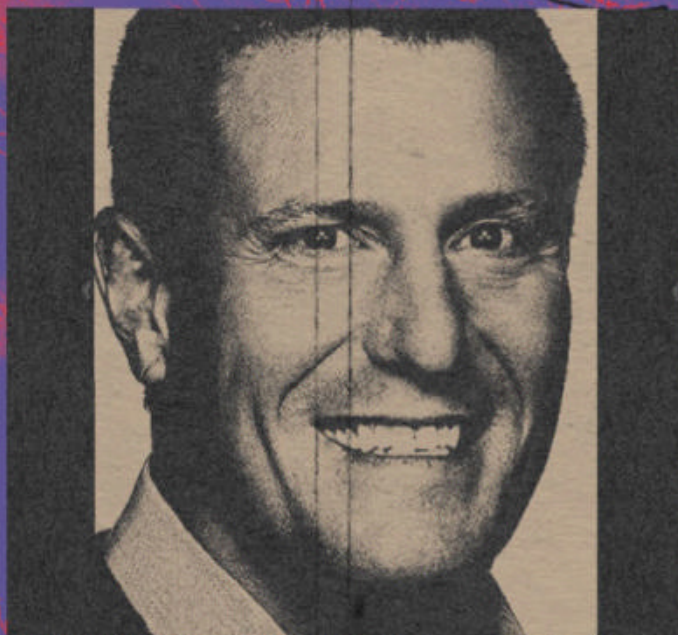
There are problems with these various scenarios, of course, beginning with how likely they are. China's security state has hacked plenty of US public agencies and stolen corporate secrets, but there is little evidence that it uses stolen data to blackmail Americans, or indulges in Russian-style political meddling. Even were it to do so, the risks should be manageable, suggests Paul Triolo, head

**Right: following Modi's lead, Donald Trump aims to ban TikTok. US chief executive Kevin Mayer has left; founder Zhang Yiming has little choice but to sell**





(1)



1.2-A



字 符 跳 动



**Other companies  
caught up in tech's  
new Cold War**

**Huawei**

The US has imposed restrictions on Chinese telco Huawei and has urged other countries, including the UK, not to use Huawei for their 5G infrastructure. In July 2020, the UK government said it would strip Huawei from its 5G networks, partly because of US sanctions which prevented Huawei from using US microchips.

**WeChat**

On August 6, 2020, Donald Trump signed two executive orders: one against TikTok, and the other announcing restrictions on WeChat, the messaging, social media and payments app developed by Chinese conglomerate Tencent. As with TikTok, the WeChat order cited national security concerns.

**Google**

Most Google services are blocked by China's Great Firewall; the company ran a censored search engine in China, but stopped in 2010. Reports in 2018 that Google was working on a new censored search engine – Project Dragonfly – led to backlash from Google employees. Google says it has no plans to launch Search in China.

of geo-technology at consultants Eurasia Group. The threat posed by TikTok is much lower than that by a company like Huawei, he says, with its deep links in core technological networks. Australia said it found no evidence to justify a ban. "On data privacy this is mostly a red herring," Triolo says. "I don't buy the national security argument."

Then there is the general incoherence of Trump's technology policymaking. In a statement responding to Trump's executive order, TikTok wrote: "The Administration paid no attention to facts, dictated terms of an agreement without going through standard legal processes, and tried to insert itself into negotiations between private businesses." Within Trump's team, business-friendly figures such as Secretary of the Treasury Steve Mnuchin worried that an outright ban could dent confidence in US technology regulation. Outside it, critics like Samm Sacks, a cybersecurity fellow at think tank New America, argue that the US is playing "whack-a-mole" rather than building a comprehensive approach to managing Chinese technology risks. "This is akin to the state-coerced nationalisation of a private company. And in the US, that is a big and worrying deal," she says.

Clearly other forces are at play. A desire for reciprocity is one, given so many US tech platforms are banned in China (although not Microsoft, one of TikTok's suitors). "You can't say this is about the US decoupling. This is us dealing with decisions China made to decouple," says another Congressional official working on TikTok. "We are finally having the debate

**'This is akin to the  
state-coerced  
nationalisation of a  
private company.  
And in the United  
States, that is a big  
and worrying deal'**



China had two decades ago, when it put in the Great Firewall because it found foreign technology threatening its political system. Only now is America catching up with foreign technology that is a direct threat to our open system."

Viewed from China, TikTok's fate is simpler to explain: the US is hobbling rival tech companies to contain China's rise. "China tech people are pissed off by this," says Gang Lu, Shanghai-based founder of media group TechNode. "People think TikTok is trying to find a solution, but the US government doesn't want that." ByteDance founder Zhang has certainly tried. Prior to Covid, he hired more executives and worked with lobbyists to press the company's case in Washington. As the pandemic struck, making travel impossible, he worked on US time in Beijing to allow for video calls with US regulators and politicians. His team moved quickly in other ways too, not least with its rapid decision to exit Hong Kong in July, after China pushed through a new national security law – an attempt to reassure US lawmakers that TikTok was serious about avoiding interference from Beijing. "Our response teams have been working around-the-clock," Zhang wrote in a memo

to ByteDance staff in early August.

Reports suggested TikTok's suitors could spend as much as \$30bn to take over the app's operations in the US and a handful of other countries, or potentially its entire international operations. The dealmaking process has been tumultuous. In August, TikTok announced it was suing the US government, claiming that the executive order to ban it ignored due process. Just days later, TikTok CEO Kevin Mayer resigned. In September, China introduced new rules which placed algorithms like TikTok's on a list of items which could not be sold without official state permission, raising doubts about whether an overall sale could go ahead at all. In mid-September, Microsoft said that ByteDance had rejected its proposal, leaving Oracle as the frontrunner – although the nature of that deal remains unclear at time of publication.

Whatever TikTok's fate, the result will be a blow for ByteDance's ambitions. Prior to its run-in with the US, Zhang had been planning an IPO for ByteDance, at a reported valuation north of \$100bn. That valuation will now be diminished, and Zhang's dreams of building China's first global internet giant along with them.



### Apple

China is a huge market for Apple, as well as the location of much of its supply chain, including rare earth metals. Apple avoided tariffs on its products following a trade deal in January 2020, but reports suggest Foxconn, the Taiwanese company that manufactures iPhones, is considering moving some of its operations to Mexico.

### Zoom

It's a US company and its Chinese-born founder Eric Yuan a US citizen, but it came under scrutiny by US politicians after it suspended some activists' accounts at the request of the Chinese government. In August, Zoom halted direct sales to people in mainland China; it is now only accessible through local partners.



### he implications of the battle for

TikTok now extend far beyond ByteDance to other China-linked tech companies. WeChat is the first casualty, following Trump's executive order. Given Tencent's app dominates online communication in China, it could potentially stop US companies in China using some functions on the app. Google and Apple may have to restrict its download, driving a further wedge between US and Chinese tech ecosystems. Few would bet against more restrictions on companies with links to China, from the cloud computing arms of Alibaba and Tencent, to drone-maker DJI and smartphone maker Xiaomi.

Other nations are yet to follow America's lead in acting against TikTok, yet with Huawei, the likes of the UK have gradually come round to Washington's point of view. More international restrictions against Chinese tech players could easily follow. Much also depends on

China's behaviour, for instance whether it responds by targeting US companies with big Chinese operations, such as Apple or Intel. Chinese foreign policy matters too. The US campaign against TikTok came into sharper focus in the aftermath of a slew of assertive Chinese actions in India and Hong Kong. Entrepreneurs like Zhang find themselves caught between a Trump administration on the warpath, and a Chinese government whose foreign policies are busily undermining trust in its own national technology champions.

On the surface, things might look better for American big tech. Facebook may now face one less major competitor. In August, founder Mark Zuckerberg launched Instagram Reels to compete with TikTok, to generally poor reviews. "Having TikTok banned is a good thing for business, at least in the short run," says Matt Perault, director of the Center on Science & Technology Policy at Duke University and a former policy director at Facebook. "But I think it's a troubling precedent for US tech companies, who will have to deal with more inconsistent and arbitrary regulation in future." Trump's actions will certainly make it harder for Chinese tech companies to break into the US market. But they are likely to make it harder for US companies to grow abroad too, as other countries, like India, begin to copy the kind of broad national security rules Trump has pushed, and to protect their own tech national champions.

Nor is Trump's crusade likely to end with apps like TikTok. "Beyond consumer apps, the world needs to be wary of the companies and technologies integrated into China's evolving mass surveillance apparatus and Military-Civil Fusion strategy," says Marco Rubio. Networks like BeiDou, China's GPS equivalent, are one threat, he suggests, providing Beijing with "political and economic leverage" over countries using Chinese technology. China's investment in areas like biotech and AI pose another. "The Chinese are reorganising their technology ecosystem to harness emerging technologies to ensure the Communist Party's dominance at home and abroad," Rubio claims.

All this points toward a rapid splintering of links forged over many decades between Chinese and US entrepreneurs, most notably in Silicon Valley "There is a big Chinese network here, of students, engineers, people who came to study," says Yao Zhang, the Chinese-born founder of RoboTerra, an educational robotics company with operations in both California and China. "We all see the advantages of Silicon Valley, but will others from China now be able to come in future?" Her concern is shared by plenty of others. "I have high school friends [in China] who I haven't seen for 20 years reaching out to me now," says one Chinese tech investor living in Silicon Valley. "People ask me: 'Will you come home? Are you safe?' People at home now think Americans see China as the enemy."

Those hoping a Biden presidency might chart a changed course are likely to be disappointed, too. "My sense is that Biden would take a more targeted approach, with less willy-nilly targeting all Chinese tech companies," says Sack, of New America. But Biden will be tough on China. And even if he did want to change paths, he may find his hands tied, given the way Trump's team has spent months rolling out new anti-China policies to bind any potential successors, including a new and hastily cobbled-together "Clean Network" programme compared by some to China's own Great Firewall, which aims to bar Chinese companies from tech infrastructure such as telecoms networks and undersea internet cables.

Just over a decade ago, then-US Secretary of State Hillary Clinton gave a speech committing the US to an agenda of "internet freedom". The philosophy it embodied, Perault suggests, saw the threats from new technology, but many benefits too, from promoting free expression to limiting censorship and encouraging innovation. Barely ten years later and the internet looks like a much darker place. Those who back tough action against companies like TikTok see themselves as the true inheritors of that agenda for technological freedom, striking a blow by pushing back against Chinese authoritarianism. Yet even they admit that in a world of deepening geo-political battles, the internet as a whole is likely to grow deeply divided with far greater state intervention, both in the US and elsewhere. "There will be significantly more tolerance of constraints on how technology is run," Perault says. For all the levity of its video clips, TikTok's fate provides a darker hint of the tech world to come. ■

*James Crabtree is a British author and journalist living in Singapore. He wrote about Jean Liu in issue 03.18*

**Above: TikTok's dancers may be having fun, but the US has serious concerns that the Chinese authorities could access personal, possibly compromising, data**



Portfolio by Vincent Fournier

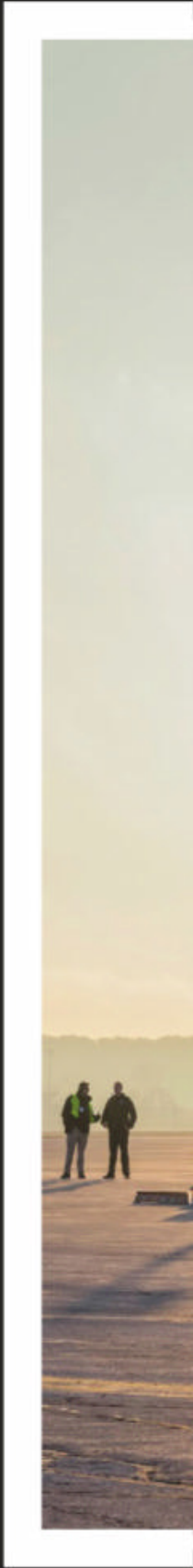
Nasa aims to send a woman to  
the Moon by 2024 –  
this is the giant-size technology  
that will take her there







A large white satellite dish, part of the Space Shuttle Challenger's payload, is being transported on a mobile launcher platform (MLP) by a crawler-transporter on the tarmac. The MLP is a complex structure that supports the orbiter and external tank. The dish is mounted on a white MLP with a blue stripe. The nose of a Boeing 747 is visible in the background, showing the aircraft's distinctive hump. The scene is set on a paved airfield under a clear sky.





*Previous spread\_* The aluminium-walled vacuum chamber is cylindrical with a domed top, and is 30.5m in diameter and 37.2m high. The Orion spacecraft driving the Artemis mission will undergo thermal vacuum tests here: the chamber is flushed with nitrogen and all the air removed, then the craft is exposed to extreme heat and cold. Next is electromagnetic testing: radio waves are used to check spacecraft systems will not interfere with each other, and that external radio sources do not affect the equipment.

*Below left\_* After landing in Ohio, the nose of Nasa's Super Guppy, a plane 43.8m long and capable of carrying more than 20 tonnes, is opened to offload the Orion spacecraft. The crew and service modules, with a total weight of 25 tonnes, are the heaviest payload ever transported in the plane. Preparations for the flight started in 2014 and involved building a horizontal transporter fixture. To date, four Orion spacecraft have been built, but Nasa plans on commissioning up to 12 for future Artemis missions. *Below\_* In November 2019, the Orion spacecraft was flown from Florida to Mansfield Lahm Airport in Ohio, before heading to Plum Brook Station. The crew and service modules travel on the Super Guppy, which has previously been used to transport sections of the International Space Station. The plane was first used in 1965 during the Space Race, when Nasa wanted to move large rocket parts faster than was possible by boat.





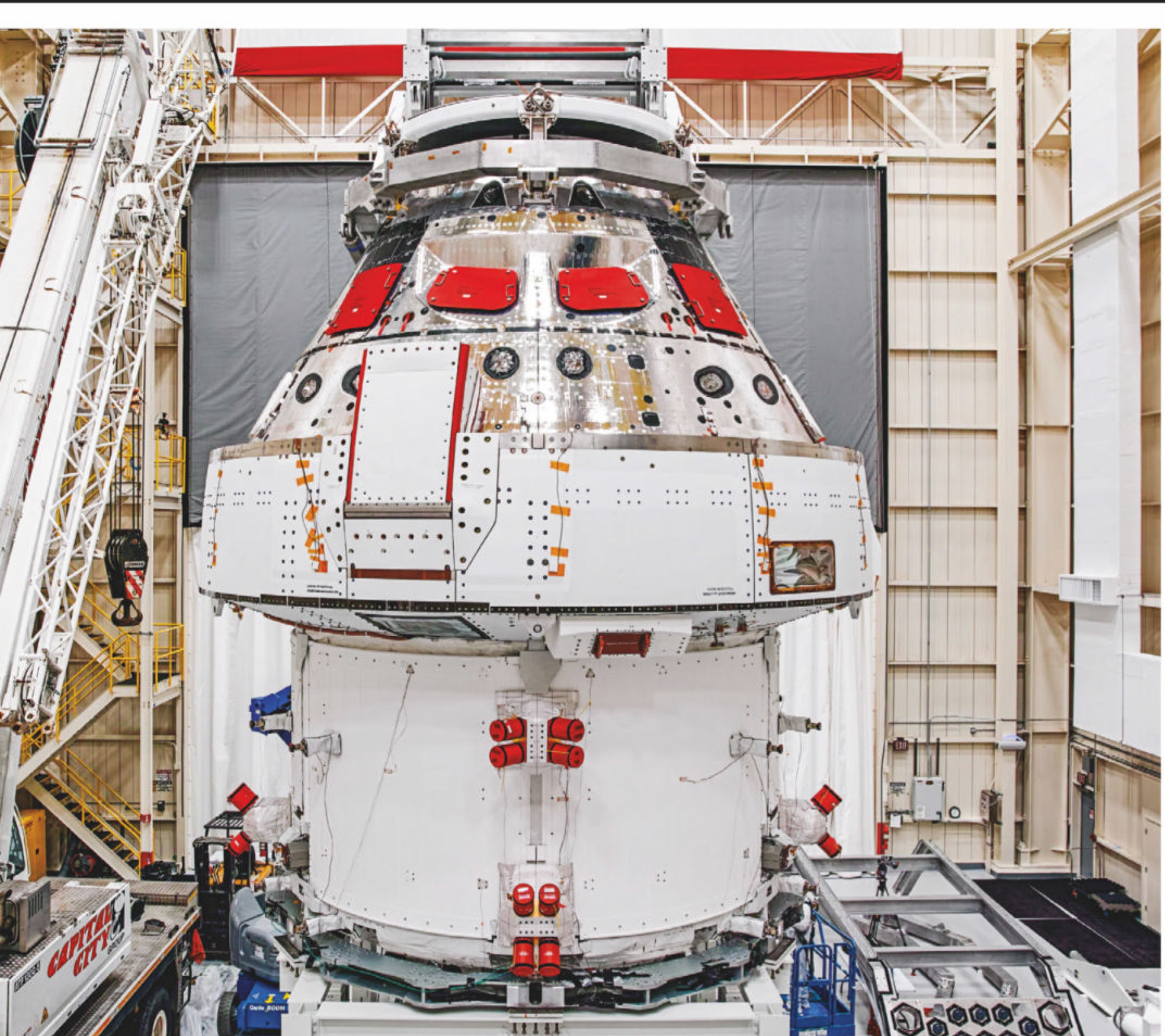
*Below\_* The Orion spacecraft is driven 66km from the airport to Nasa's Plum Brook Station, where it will spend four months undergoing testing in the Space Environments Complex. The facility is home to the largest vacuum chamber in the world, used to simulate the conditions of space. Called the Space Power Facility, the chamber has a volume of 22,653 square metres and is capable of reaching 0.000004 torr – the closest a spacecraft can get to the vacuum of space outside of experiencing the real thing.



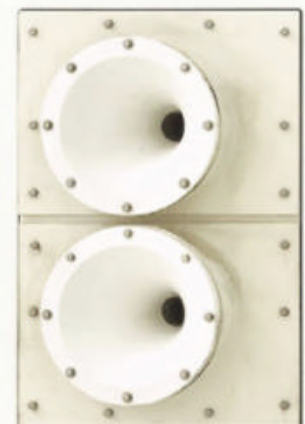
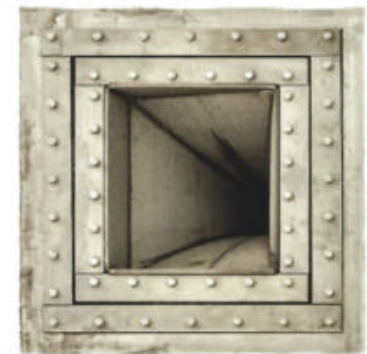
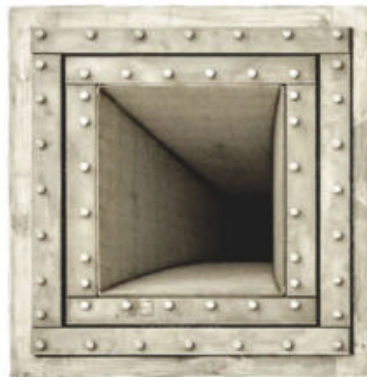
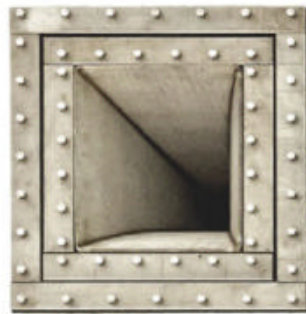
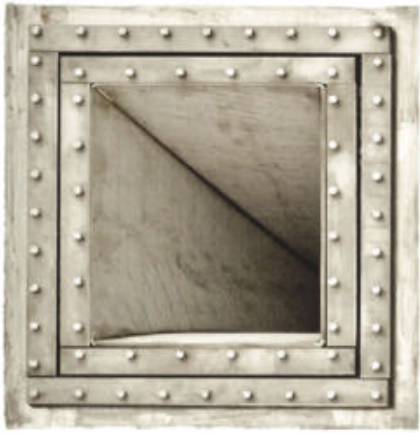
ADDITIONAL PHOTOGRAPHY: NASA. WORDS: ABIGAIL BEALL



*Below\_* After four months of testing, the Orion spacecraft will return to the Kennedy Space Center in Florida for final processing and preparation before its 2021 launch. During the Artemis I mission, Orion will spend three weeks in space, travelling past the Moon before entering its orbit, and returning to Earth, splashing down in the Pacific Ocean. While in space, it will deploy 13 cubesats to study the Moon. This will mark the first step in getting the first female astronaut on to the surface of our natural satellite.

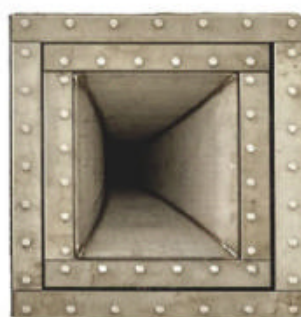
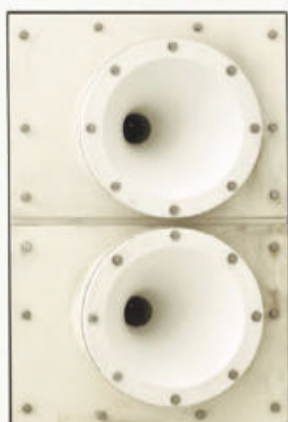
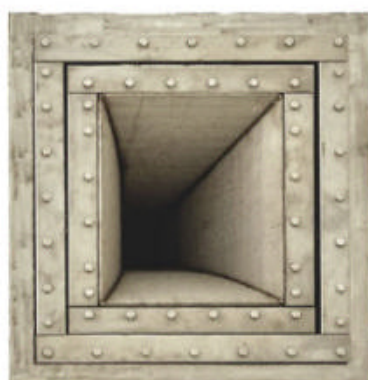
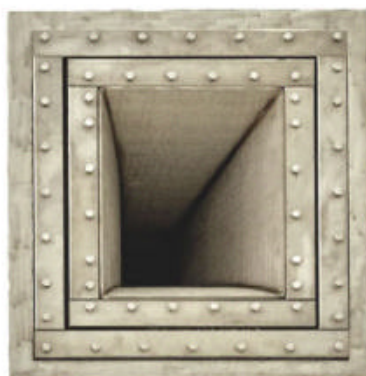






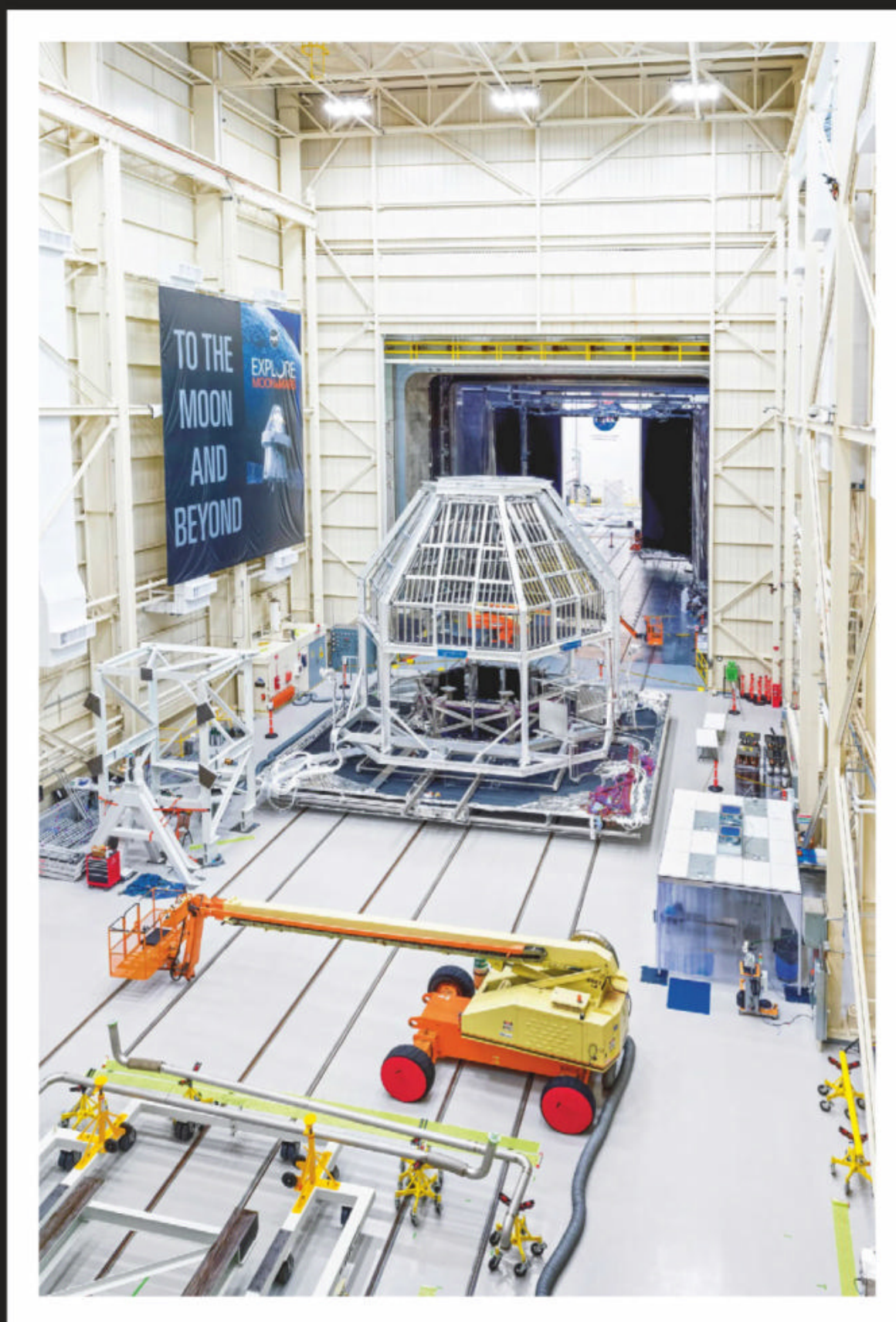


0  
9  
7





*Previous spread\_* The horn wall in the Reverberant Acoustic Test Facility has 36 horns of various sizes, each capable of producing a range of frequencies. The metallic horns are hydraulic; the white ones are electrically powered. Once the Artemis I crew module splashes down after its mission, it will be brought back to the facility in Ohio for more acoustic tests. "They'll fish it out of the ocean, refurbish it a little and clean it up," says Smith. "Then it'll be back here in a couple of years."





*Left\_* The cage-like structure in this image is the Heat Flux System, which is used during thermal vacuum tests. “The bars of the cage are all heater bars,” says Smith, “which allows us to do a lot of types of tests.” The bars can separately heat different parts of the spacecraft to simulate travelling towards or away from the Sun. In total, Orion spent 47 days inside the chamber, cycling from  $-156^{\circ}\text{C}$  to  $149^{\circ}\text{C}$  – close to, but not quite, the extreme temperatures the spacecraft will experience in space.

*Below\_* In 2018, this Orion crew module was placed in the Space Environments Complex’s Reverberant Acoustic Test Facility at Nasa’s Plum Brook Station. The largest facility of its kind, it exposes spacecraft to the sound volumes they will experience during launch and ascent. The chamber has concrete walls 1.8m thick and can produce up to 163 dB within the  $2,860\text{m}^3$  room. While testing, the room is filled with nitrogen to minimise any absorption of sound. ▣





By João Medeiros

# body

Neuroscientist Sarah Garfinkel's work is revealing that the heart and body exert huge influence over the brain – and that connection could help autistic individuals to better process their emotions



Photography: Jonathan Minster

and  
&





○

In February 2019, Jane Green enrolled on an experimental clinical trial targeted at autistic individuals with anxiety disorder.

Green, who is in her mid-50s, is an autism activist and educator.

She describes her autism as something that enables her to be constantly “creative and buzzy” but makes her prone to irritation when things don’t get done.

“People call it obsessive,” she says.

“I call it passionate. I’m like a very busy duck swimming against a strong current, all the time.”



THE CONNECTION BETWEEN THE HEART  
AND THE BRAIN MAY BE KEY TO NEW  
THERAPIES FOR ANXIETY DISORDERS

REEN ALSO HAS HYPERMOBILE Ehlers-Danlos syndrome, a rare genetic condition that degrades collagen, the glue that binds together skin, bones, muscle and the internal organs. Although she has only been diagnosed recently, she has been afflicted with painful joint dislocations and sprains for as long as she can remember. “Doctors used to call me bendy,” she says. One day, she recalls, she was walking across a car park and her ankle just kind of “fell out”. People who suffer from hypermobility also have stretchy and delicate skin and will often have immune complications. They are also seven times more likely to be diagnosed as autistic.

On the first day of the trial, which took place at the Brighton and Sussex Medical School, Green was welcomed by a young postdoctoral researcher by the name of Lisa Quadt. The trial was advertised as an “innovative psychological therapy” called ADIE (which stands for Aligning Dimensions of Interoceptive Experience), which the researchers hoped could reduce some forms of anxiety in autistic individuals for whom standard pharmacological treatments had proven ineffective.

Quadt explained that severe anxiety in autistic adults is common and could be caused by overreactions to sudden physical sensations. These weren’t mental forms of anxiety, such as depression, but rather fully embodied ones, like panic attacks, when a twinge in the chest and an acceleration of heartbeat can trigger the feeling that your heart is





'If we see a snake, our hearts don't beat faster because we are scared. Seeing the snake will increase our heartbeat and when that's registered in the brain, that's what leads to the feeling of fear'



## Sarah Garfinkel describes

going to stop and that you're about to die. The therapy would hopefully help participants by attuning them to these bodily sensations and, as a result, enable them to control them.

Green described to Quadt how she would often feel assailed by sensations that would emerge unexpectedly and rapidly overwhelm her. She described a particular pattern as the “woosh”, a feeling akin to being inside a falling elevator. “It just goes haywire. It just goes crazy,” she says. She feels her body being pumped with adrenaline and histamines, leaving her gasping for air and enveloping her skin with a red, itchy rash that feels so hot “you could cook an egg on it”. “Once I had a crisis so bad I ended up in hospital and couldn't eat for months,” she says. “It made me really anxious because everything is out of control.”

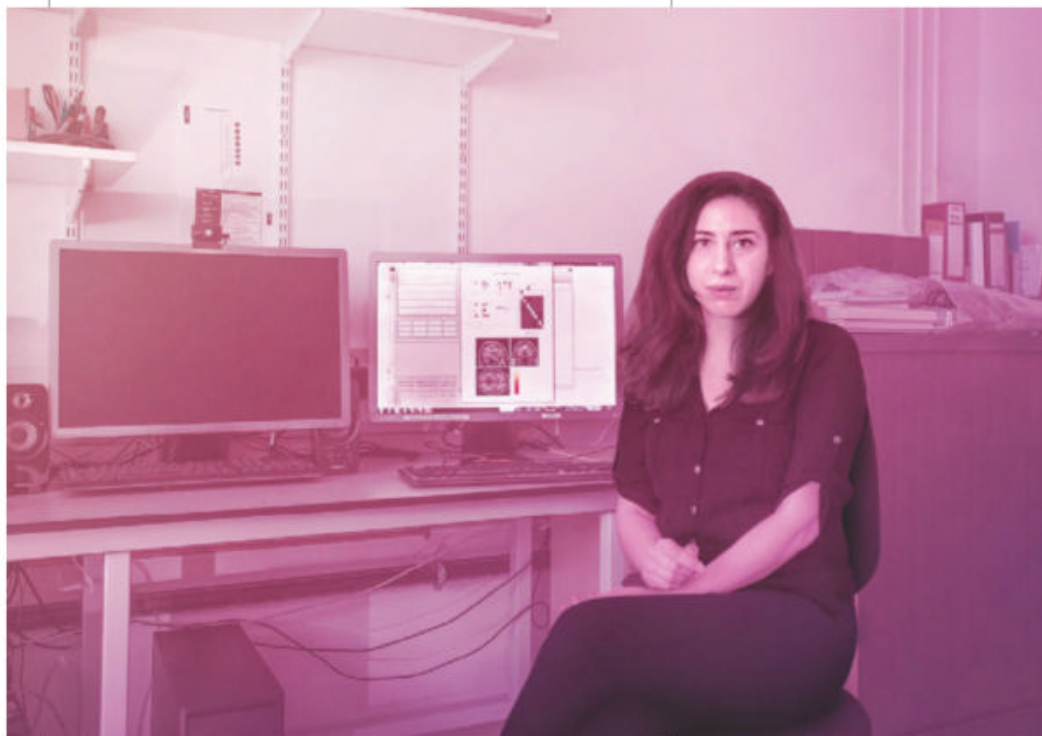
As part of her initial assessment, Green was asked to fill out questionnaires and do a few tests. One test was a heartbeat tracking task involving the participant counting the number of heartbeats in a given interval of time, which varies between 20 to 45 seconds, for a total of six trials. Participants have to try sensing their heart internally, rather than physically feeling for a pulse. They are also connected to a pulse oximeter which records their actual heartbeats.

The task is a test of how good people are at detecting their own heartbeats. Those performing it tend to underestimate the number of beats. Individuals with a slower heart rate, like athletes, are usually more accurate. When Quadt asked how many she had counted, Green had no idea, so she just made a wild guess. “I'm quite competitive and I wanted to get it right, but I didn't really understand it,” she says. “I tried to find a pattern but the times kept changing, so I couldn't, so I just kept guessing.” She had no idea how she was supposed to sense her heart and began to feel irritated. She thought to herself: “Who invented this awful thing?”

HERSELF AS AN EMOTIONAL PERSON. Her emotional range is seldom moderate: when she's happy, she's really happy; when she's sad, she's very sad. For her, even the emotions evoked by mundane occurrences find distinct bodily expressions: she's the type of person who literally jumps when watching horror movies, who visibly tenses up in pain during awkward social situations. “I'd

probably be the worst therapist in the world, because when someone's having a hard time, I just sit there and weep,” she says. “But that also means I share other people's joy and pain and that's a nice thing. It's what makes us human and what connects us.”

In 2004, Garfinkel embarked on a career as a neuroscientist. Her PhD project, at the University of Sussex, was an investigation on the effects of alcohol on memory. “The hypothesis was that alcohol only affected explicit memory, leaving implicit memories intact,” she says (implicit memories are things you remember unconsciously, like riding a bike, whereas explicit memories are when you consciously try to memorise something, such as reciting a list of words). “On my first experiment, I got everyone so hammered, I basically knocked out all of their memories, both implicit and explicit. It was not very profound.”



NEUROSCIENTIST SARAH GARFINKEL  
IN HER LAB OFFICE AT THE SACKLER  
CENTRE FOR CONSCIOUSNESS SCIENCE

Four years later, she moved to the University of Michigan to study the emotional processing of fear memories in war veterans from the Iraq and Afghanistan wars who suffered from post-traumatic stress disorder. “They would often have memory flashbacks. If there was a loud noise, they jumped, as if they were under attack,” she says. She was intrigued by the observation

### GLOSSARY

#### INTEROCEPTION

The sensory system that picks up on the internal state of your body

#### EXTEROCEPTION

The sensory system that picks up on stimuli external to your body



that during these flashbacks, whereas many veterans would start sweating and their hearts would race, others would go numb, as if disconnected from their bodies. “This wasn’t about the external world. They were carrying it with them internally,” she says. When she made this observation to a fellow researcher, she was told to discard the data related to the non-responders. “I didn’t like that,” she says. “There was something happening in their body that was interacting with their brain and contributing to these different symptoms.”

Suspecting that mainstream neuroscience couldn’t provide an adequate explanation for what she was observing, Garfinkel found a new area of research called interoception. In contrast to exteroception – the collection of senses, from vision to smell, that allows us to scan and palpate the external world – interoception is about the perception of our visceral world. It encompasses the biological sensors that permeate our internal organs – the heart, the gut, the lungs – and continuously track the variations of temperature, pressure and chemistry within. This stream of biological information constantly flows from the body to the brain, often barely perceptible, seldom caught in the spotlight of consciousness. But when it does emerge, we register its undeniable physicality: the churning gut, the sweaty palms, the galloping heart. These are the sensorial signatures emotions are made of.

Garfinkel was particularly fascinated with the research of a British psychiatrist called Hugo Critchley. Like many other researchers in the field, Critchley devoted his studies to the heart, an instrument of choice in the study of interoception because its distinct and rhythmic beat is easy to detect and measure. In 2004, he published one of the most influential reports in the field, a study of how visceral information activated a region in the brain called the insula. Using the heartbeat-tracking task as a gauge for how accurate people were in detecting their bodily sensations – a measure called interoceptive accuracy – Critchley showed that the more accurate someone was at counting their heartbeats, the higher the activation and grey matter volume of the insula.

#### INSULA

A part of the brain thought to be involved in processing emotion

This finding resonated with Garfinkel, as she too had seen the same sort of hyperactivation of the insula in her PTSD patients. “He was really a pioneer in measuring the signals from the body and the brain and integrating the two together. That just made sense to me,” she says.

In 2011, Garfinkel managed to find a position under Critchley, at the Sackler Centre for Consciousness

“There was something happening in their body that was interacting with their brain and contributing to these different symptoms’

Science at the University of Sussex. At the time, Critchley was investigating how the state of the body could influence mental processes. This was informed by a theory of emotion that can be traced back to American psychologist William James, who first proposed that the sensing of bodily changes was emotion itself. So, we don’t cry because we are sad, but we are sad because we cry; the heart doesn’t pound because we are afraid, but we are afraid because of the pounding heart. He wrote in 1884 that “bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur is the emotion.”

Garfinkel explains: “If we see a snake, our hearts won’t beat faster because we are scared. Seeing the snake will increase our heartbeat and when that’s registered in the brain, that’s what leads to the feeling of fear. He reversed the causality.”

Critchley was particularly interested in the effect that cardiovascular arousal has on the brain. As the heart pulsates, blood is injected into the aorta, extending the arterial wall and stimulating pressure-sensitive sensors called baroreceptors attached to it. These relay blood pressure information to the brain, activating it in proportion to how strong and fast the heart is beating.

Experiments had already been conducted that showed that if you gave someone an electric shock in

time with the beat of their heart (as opposed to between heartbeats) they would perceive it as less painful. “Pain is dampened down when the heart and the brain are in active communication,” Critchley says.

He and Garfinkel discovered that this inhibitory effect also affected a cognitive process such as memory. In their study, “What the Heart Forgets”, they showed that when people were presented with a list of words to remember, they tended to forget the words that had been shown in synchrony with their heartbeats.

In subsequent research they found that, on the other hand, cardiac signals could boost the perception of fear. In that study, they flashed pictures of fearful faces to participants, either in synch or in between heartbeats. When they asked people how intense they found the faces, they would systematically judge faces as more fearful if their presentation coincided with their heartbeats.

To Garfinkel, the findings clarified the biological rationale for cardiovascular arousal’s influence on the brain. “When you’re feeling threatened, you need to be super alert to threats in the environment,” she explains. “Having good memory recall or being aware of pain isn’t necessarily helpful.”

They also illustrated how our experience and perception of the world fluctuates to the tune of our heartbeat. “They brought centre stage the fact that the most important thing for the brain is the body, the vehicle that houses the brain,” says UCL’s Karl Friston, a leading neuroscientist. “It is remarkable that, over a timescale of several hundred milliseconds, our physiological state determines in a fundamental way how we experience the world as a sentient creature. You won’t find anything like that in neuroscience in the 20th century.”

#### BARORECEPTORS

Sensors in the heart and blood vessels that sense blood pressure





AS A TEENAGER, GARFINKEL USED TO help her mother, who had given up a career in law to run a crèche for autistic children. “I was very moved by working with these kids: they were bright and kind and quirky,” Garfinkel says. “There’s an honesty to autistic individuals that I really respect.” The experience left her with the idea that the characterisation of autistic people as individuals who lacked empathy and had little need for social interaction was a misunderstanding.

As a researcher, Garfinkel began working with autistic adults in 2013 at the Neurobehavioural Clinic in Brighton, where she noticed many struggled with sensory overload – an overwhelming sensation that the external world was too intense, too bright, too loud. They also seemed to have problems identifying their own emotions, or forgetting to eat because they didn’t know if they were hungry. “They might acknowledge that they don’t feel right, but they don’t understand if they feel angry or sad. They can’t work it out,” Garfinkel says.

If those with autism were indeed swamped or perplexed by their own bodily sensations, that had implications for their ability to understand the emotions of others. “You can imagine that gets quite overwhelming,” she says. “I think it makes you vulnerable to having emotions that might not fit the situation or that might not make sense to other people or yourself.”

Loneliness, for instance, is four times higher in autistic individuals. “We asked how they feel about it and it’s something that really

upsets them,” Garfinkel says. “They actually long for social connection, but they don’t know how, or have experienced so much rejection that they just don’t try anymore.”

Empathy is deeply rooted in interoception: the ability to detect our own emotions determines our capacity to sense those of others. In response, our bodies often mirror other people’s bodily changes, re-enacting those same emotions on a visceral level. In a study conducted at Hugo Critchley’s lab, researchers showed that when looking at photos of sad faces, the viewer’s pupils shrank in response.

In 2016, Garfinkel came across a study that tested the empathy response of autistic individuals to other people’s pain. The participants were shown photographs of painful situations – for example, a hand about to be stabbed – and asked to judge if the person depicted was in pain or not, while their brain activity and skin conductance was measured. The brain scans showed that autistic individuals had reduced response when compared with the neurotypical group, leading the study authors to conclude the subjects had presented an empathy deficit.

However, Garfinkel noticed that the graph depicting their skin conductance response was actually orders of magnitude higher. “If you read the paper, it talks about the brain differences but it glosses over the body differences,” Garfinkel says. And their body responses told a completely different story.

Garfinkel wondered what was different about the autistic individuals’ interoceptive abilities that affected their interpretation of bodily sensations. That year, with Critchley, she ran a large-scale study with 80 individuals. Each participant was given two different sets of interoceptive tests. One included the heartbeat-tracking task that tested interoceptive accuracy. The second was a self-report questionnaire about their awareness of bodily sensations, covering everything from stomach pain to urge to defecate. This was a subjective measure that Garfinkel called interoceptive sensibility. Traditionally, researchers used these terms interchangeably, assuming they were synonyms. “It was a mess,” Garfinkel says. “They were calling

everything ‘interoceptive awareness’ regardless of whether they were using a questionnaire or a brain scan.”

On comparing the results, Garfinkel found there was no correspondence between how good individuals were at assessing their interoceptive abilities and how good they thought they were: being an accurate heartbeat detector did not also mean that an individual had any insight into their ability. “This gave us a systematic way of thinking about meta-cognitive awareness in a very specific way, rather than a general way,” Critchley says. “It was about how much insight you have in your ability.”

More importantly, this also gave the researchers a novel suggestion as to why autistic individuals may struggle to process emotions. In a subsequent study, Garfinkel found that while autistic adults generally had poor interoceptive accuracy when compared to a neurotypical group, they tended to rate their own abilities highly. “There was this mismatch between how good they thought they were and how good they actually are,” Garfinkel says. This discrepancy, she found, caused problems like anxiety. “If you think you have very good interoception, but your body is sending signals that you’re not able to correctly identify, then that’s associated with high anxiety.” She concluded that if she could reduce this discrepancy, she might be able to treat their anxiety. The question was how.

## When Garfinkel first

TRIED THE HEARTBEAT-COUNTING task, soon after she joined Critchley’s lab, she assumed she would perform well. “Turns out I was terrible,” she recalls. “But it raised questions about why I think I’d be better.”

However, each time she performed the task, be it to test the equipment or as simple curiosity, she improved. “When I started I kept trying to focus on my chest and actually people don’t

### INTEROCEPTIVE ACCURACY

How good an individual is at perceiving internal sensations, such as a heartbeat



necessarily feel [it there]. They can feel it in other parts of their body. Once you're aware of that, you can focus on other parts," she says.

This told her that while many who studied interoceptive accuracy seemed to consider it as a fixed trait, it could be a trainable one. And if she could train autistic individuals to have better understanding of their body, maybe she could reduce their anxiety.

The ADIE clinical trial was launched in 2017. It recruited more than 120 people, each completing eight sessions over several weeks. Participants performed the heart-beat-counting task, as well as a heartbeat discrimination task – they were played a series of beeps, and had to say if they were in synchrony with their heartbeat or not. To assist in the training, after each test Lisa Quadt would give feedback on their performance. They would also be asked to do some mild exercise before the sessions, to make their heartbeat more perceptible. The researchers encouraged participants to find out what worked for them.

After only four sessions, Quadt noticed that although the results were encouraging, the participants still seemed unaware of the progress they were making. "They would say 'This is stupid, I don't know why I'm here.' One person got more anxious. I don't think they realise how much they've improved," she says.

Jane Green was no exception. "Even her first assessment was good," Quadt recalls. But Green didn't believe her. "I had no idea what I was doing," she says. After a while, however, she realised that she could sense her heartbeat under her chin. Near the end of the trial, she could sense her heartbeat at will.

What difference this made to her was revealed one day, during a work meeting. "I had two people that began being quite aggressive. I didn't know them. They interrupted the meeting and abused me verbally," she recalls. She began feeling the "woosh", but told herself "I know what's happening. My heart's going to go crazy." She visualised it like a fountain of stuff being ejected and her squashing it down. "At the end, I got a bit itchy, but nothing major," she says. "That made me see that this was like an armour to get through life."

According to preliminary data from the study, interoceptive training resulted in marked reduction in anxiety symptoms. This is corroborated by some of the feedback from the partic-

ipants: "As the inner channel gets clearer, the outer channel gets more quiet." "When I notice the impacts of anxiety on my body I am more aware of them and am able to reassure myself that it is just a physical reaction. I am better at taking deep breaths and trying to slow down my breathing and heart rate, rather than letting it spiral."

Garfinkel considers these answers a unique insight into the psychology of interoception. "I feel like our senses are like a seesaw between the outside world and the inside world, trying to find equilibrium" she says.

Garfinkel has extended her studies to include conditions such as schizophrenia and PTSD. "Schizophrenia fascinates me because it's associated with a very regular beating heart," she says. "But the heart doesn't beat regularly. It is associated with patterned responses that can be elicited by different scenarios. With



schizophrenia, it's like the heart is disconnected from everything."

She adds that after researchers observed that patients with mental health disorders who also took statins made fewer hospital visits, an ongoing clinical trial into the effects of blood pressure medication for people with PTSD was launched. "We've been bombarding the brain with drugs for depression and schizophrenia, without much progress in 20 years," she says. "I hope that the future of mental health conditions will be these body-based, peripheral physiology-based interventions." It is time, she hopes, to listen to our hearts. ■



A REGION OF THE BRAIN CALLED THE INSULA IS RESPONSIBLE FOR MANAGING THE FLOW OF DATA FROM OUR ORGANS

#### INTEROCEPTIVE SENSIBILITY

A person's subjective assessment of their own interoceptive abilities

*João Medeiros wrote about Mariana Mazzucato in WIRED 11.19*



**BY OLIVER  
FRANKLIN  
-WALLIS  
→ WE  
WERE  
PROMISED**

# **JET PACKS**

**→ INVENTORS  
LIKE RICHARD  
BROWNING  
HAVE BEEN  
TRYING TO  
BUILD JETPACKS  
– ONCE THE  
DEFINING IMAGE  
OF OUR UTOPIAN  
FUTURE –  
FOR A CENTURY.  
NOW, THEY'RE  
FINALLY HERE.  
BUT WHAT ARE  
WE GOING TO  
DO WITH THEM?**

**PAGE 108 ←  
PHOTOGRAPHY:  
SHAMIL TANNA**

**Right: Richard Browning, founder of  
Gravity and inventor of the  
jet suit which allows him to take to the  
air like a real-world superhero**







## THE FIRST TIME SOMEONE FLIES A JETPACK,

**A CURIOUS THING HAPPENS: JUST AS THEIR BODY LEAVES THE GROUND, THEIR LEGS START TO FLAIL. ADRENALINE FLOODS INTO THE BLOODSTREAM. THE LUMBRICAL MUSCLES IN THE FEET TIGHTEN, TOES GRASP DESPERATELY AT THE EARTH. IT'S AS IF THE VESTIBULAR SYSTEM CAN'T QUITE BELIEVE WHAT'S HAPPENING. THIS ISN'T NATURAL. THEN SUDDENLY, THRUST EXCEEDS WEIGHT, AND – THEY'RE ALOFT. MILLIONS OF YEARS OF EVOLUTION ARE OVERCOME IN AN INSTANT, TWO DIMENSIONS BECOME THREE. LATITUDE, LONGITUDE, ALTITUDE.**

It's that moment, lift-off, that has given jetpacks an enduring appeal. Human beings have long dreamed of flying outside the confines of an aircraft, but without lift-off, existing means – parachutes, hang gliders, wing suits – are really elegant ways of extending a fall.

"It's indescribable, in an overwhelming, visceral kind of way," Richard Browning says. Browning, who is 41, brown-haired and bearded, with the lean physique of an endurance athlete, is the founder and CEO of the jetpack startup Gravity Industries. (Its slogan: "we build 1,000 horsepower jet suits".) He is also its main designer and chief test pilot. Since launching Gravity three years ago, Browning has taken off thousands of times in more than 30 countries, set a Guinness World Record (twice) and accrued more than ten million YouTube views. But he still remembers his first lift-off: November 2016, on a farmyard a few minutes from his house in Salisbury.

At the time, Browning was an oil trader, with a steady desk job at the petroleum giant BP. But Browning has always been a tinkerer, and drawn to pushing limits. He runs ultramarathons; practises callisthenics; and served six years in the Royal Marines Reserve, earning his green beret. At BP he had developed an innovative method of tracking global oil movements by monitoring ships' GPS transponders. The system was built on a £20,000 budget and, he says, made the company £50 million within six months. (Similar systems are now standard across the industry.) "He would always be doing something else, something big, something unusual," Maria Vildavskaya, one of Browning's former colleagues and Gravity's COO, says.

In the spring of 2016, Browning decided to buy a jet engine on the internet. It was not an entirely impulsive purchase: Browning comes from a long line of aeronauts. His maternal grandfather, Sir Basil Blackwell, was a former CEO of Westland Helicopters, the other a wartime pilot. His father, Michael Browning, was also an aeronautical engineer and a serial inventor. As a child Browning would spend his holidays home from boarding school helping out in his father's workshop. Together they would build model gliders from balsa wood, then drive up to a nearby hilltop to launch them. "Thanks to my father and my grandfather, I could probably describe how a jet engine works at the age of ten," he says.

The engine Browning bought was a micro gas turbine. Essentially jet engines in miniature, micro gas turbines compress air at extremely high velocity, then burn it with fuel (usually

kerosene) to generate thrust. Although far too small to use on full-size civilian aircraft, the technology has advanced rapidly in recent years, largely thanks to amateur enthusiasts and a growing market for military training drones. "The world of micro gas turbines had been entirely dominated by model aircraft people, so they'd accelerated in this kind of unbound way," Browning says. The chief draw to the technology is its size: an engine not much larger than a two-litre Coke bottle and weighing only 1.9kg can put out 22kg of thrust. Join a few together, Browning theorised, and you'd have enough power to lift a person.

Browning fired up the engine as soon as it arrived. "My god, the noise was unbelievable," he says. Encouraged, he built an aluminium arm housing, and repurposed the trigger from a power drill as a throttle. Soon he was standing in a country lane with what looked like a supercharged leaf blower on one arm, attached to a fuel tank in a mop bucket. "It was a profound moment," he says. He worried that the torque from the engines would twist his arm off, but "it was just a spongy push, like a firehose of water."

Over the following months, Browning's nascent jet suit became an obsession. Every night, he would wake up at 1am and set to work for three or four hours on the suit in a spare bedroom, and then sleep on the train commute into London. One engine became two, then four, then six: two attached to each arm mount, and one strapped around each ankle. The fuel bladder he hid inside

**Richard Browning hovers above a lake at the New Forest Water Park in Hampshire. The engines on his back and arms create a "teepee of thrust" that allows him to fly**







a rucksack, secured with a climbing harness. At first, he kept the idea mostly to himself. “Nobody thought that it would work,” he says. At weekends, Browning would drag his family out to the farmyard to test it. While his children played, Browning attempted to fly.

The early tests were a string of failures. Browning couldn’t stay aloft, managing only a series of elongated bounds. He frequently fell, and when he tried using a safety harness he found himself being thrown around like a marionette. The engines were temperamental, and expensive. Every breakage required sending it back to the German manufacturer for refurbishment. “It was just chaos,” he says. “A little pop and a flash and a bit of smoke, and something would have shorted. I was completely exhausted and thinking, what am I doing?” Still, with each failure, there was progress. “I was driven by a slightly irrational excitement for the journey,” he says. “I kept thinking: this works.”

Then, one weekend in November 2016, it happened. After another brief Moon bounce, Browning held down the throttle trigger, leaned hard on his arm engines and – lift-off. There’s footage of the moment: Browning, one leg flailing, flying across the courtyard, and landing slightly off balance. The flight lasted a little more than six seconds. But still, one thought crossed his mind as he beamed for the camera: “I just flew! I just flew!”

**Right: Jet Suit inventor Richard Browning in the Gravity workshop, which is situated in an outbuilding of his house in Salisbury**

## THE IDEA OF JET PACKS DATES BACK TO AT LEAST 1919,

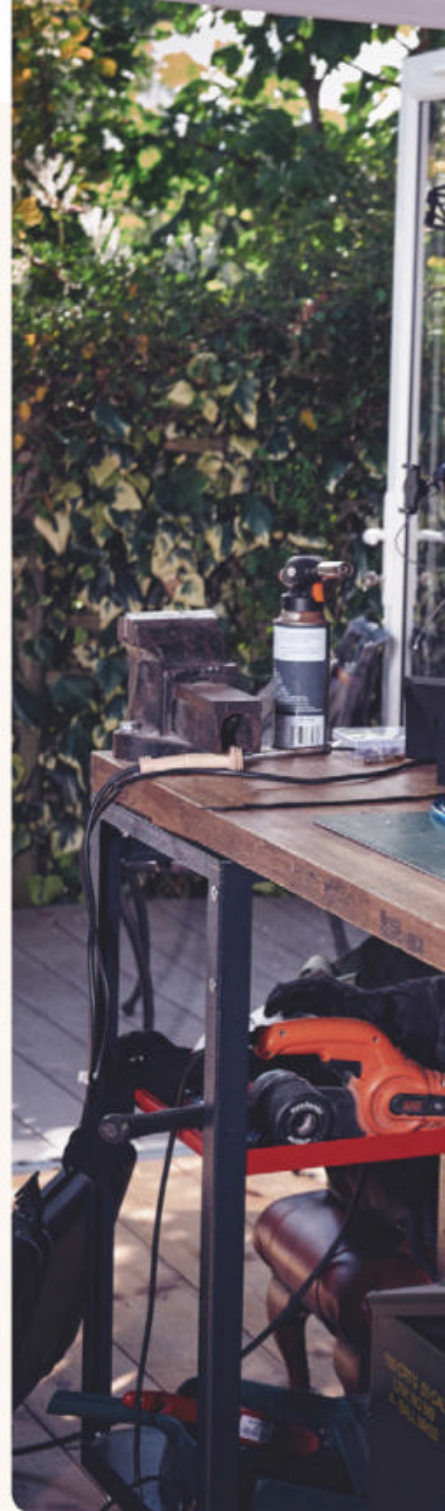
when a Russian inventor called Alexander Fedorovich Andreev filed a patent for a rocket housed inside a knapsack. (Until the 21st century, almost every jetpack was in fact a rocket pack.) Andreev imagined soldiers wearing the devices, allowing for “the siege of fortresses, bypassing all Earth obstacles [to] fly over freely to the rear of the

enemy.” His device was never built, but the idea spread. During World War 2, the Nazis worked on the Himmelstürmer, a wearable V1 rocket intended to enable troops to leap high obstacles. That didn’t make production either, but when the US military recruited Germany’s rocket scientists after the war, jetpacks came with them. By the 1960s, the US armed forces were testing designs including a “jump belt” dubbed Project Grasshopper, as well as flying platforms intended to carry snipers high above the battlefield.

In 1962, Bell Aerosystems debuted a silver and white jetpack design, with two foil-covered exhaust nozzles protruding out from behind its fuel tanks. Dubbed the Bell Rocket Belt, it ran on hydrogen peroxide, and could carry a pilot for 21 seconds, enough time to fly about 250m. Though its limited range proved useless for military applications, the Bell Rocket Belt caused a sensation. Soon jetpacks were appearing everywhere from *The Jetsons* to Bond movie *Thunderball* – in which James Bond (actually pilot Bill Suitor) flew a Bell Rocket Belt. Even decades later, jetpacks starred in *The A-Team* and the 1984 Olympic opening ceremony. Everyone agreed they were the future of personal transportation – it seemed to be just a question of when.

But then the jetpack fizzled. Rocket propulsion was inefficient and heavy; despite improvements, pilots were unable to carry enough hydrogen peroxide to fly for more than 30 seconds. In such a short window, you couldn’t fly high, or very far, nor carry heavy loads. Beyond the spectacle, nobody could quite work out what jetpacks were for. Bell abandoned the Rocket Belt in the 1970s, and then so did almost everybody else. A few die-hard inventors continued, with sometimes fanatical zeal. (In 1999, a US startup’s attempt to replicate the Bell Rocket Belt ended in a lawsuit, kidnapping and murder.) But mostly, jetpacks became a joke – they promised us jetpacks – about what the future might have been.

**Within a few weeks, Browning had** refined his jet suit system enough to make regular, sustained flights. He moved the thrusters on his feet (too unwieldy) to a spot on his lower back. Between his arms and the rear pack, the jet exhausts form what Browning calls “a teepee of thrust, like the poles of a tent.” When we feel ourselves falling, we intuitively put out an arm to catch ourselves, so flying was surprisingly intuitive. “Logically, it is a Newtonian process of just throwing high velocity air one way and you being pushed the other,” he says. With some seed funding from a friend, Browning filed a patent







application for the suit and formed a company. He named it Gravity Industries, after his newly vanquished foe.

Browning was conflicted over how to unveil his creation. When he was in his early teens, his father gave up an office job to start his own company, selling an innovative mountain bike suspension of his own design. “He constantly talked about the success that we were going to enjoy, hopefully, with this breakthrough,” Browning says. But the business struggled, and the family fell into financial trouble. Browning’s parents’ marriage fell apart. “It was a great engineering idea, but it was a pretty cutthroat environment at the time, and he got screwed over by a series of people,” Browning says. Browning’s father struggled with his mental health, and when Richard was 15, he died by suicide.


“When my father died, I had a very powerful example of what can go wrong when you follow a pioneering idea – you know, most of the time it doesn’t work out,” Browning says. Even as he found himself caught up in the potential for the suit, he thought about his father. “I’m terrified of risk,” he says. “I hate the idea of seeing risk hurt me, or someone else, or cause the financial instability – and

then hurt – that I saw as a kid.” Browning called his jet suit the Daedalus, after the mythical Greek inventor and father of Icarus, he who flew too close to the Sun.

Initially, he didn’t have much of a business plan. To mitigate his chances of failure, he didn’t quit his job, but took a two-year sabbatical (he officially left BP in 2019). “I was mentally prepared for this being a sort of YouTube five minutes, then back to the day job,” he says.

On April 1, 2017, he launched Gravity, simultaneously releasing two short YouTube videos, one with WIRED, and another with Red Bull. The response was immediate. The media christened Browning “the real-life Iron Man”. “The videos did, like, a billion impressions within a week,” Browning recalls. Shortly afterwards he received a call from Chris Anderson, the founder of the TED conference. “He said ‘Oh my god, please come and do a talk. We’ve made some space on the same day as Elon Musk and the Pope.’” The venture capitalist Tim Draper, who has invested in Tesla and Twitch, invested \$650,000 after seeing Browning fly the suit once in a San Francisco car park. The deal, signed on the back of a \$100 note, valued the fledgling company at \$6.5 million.

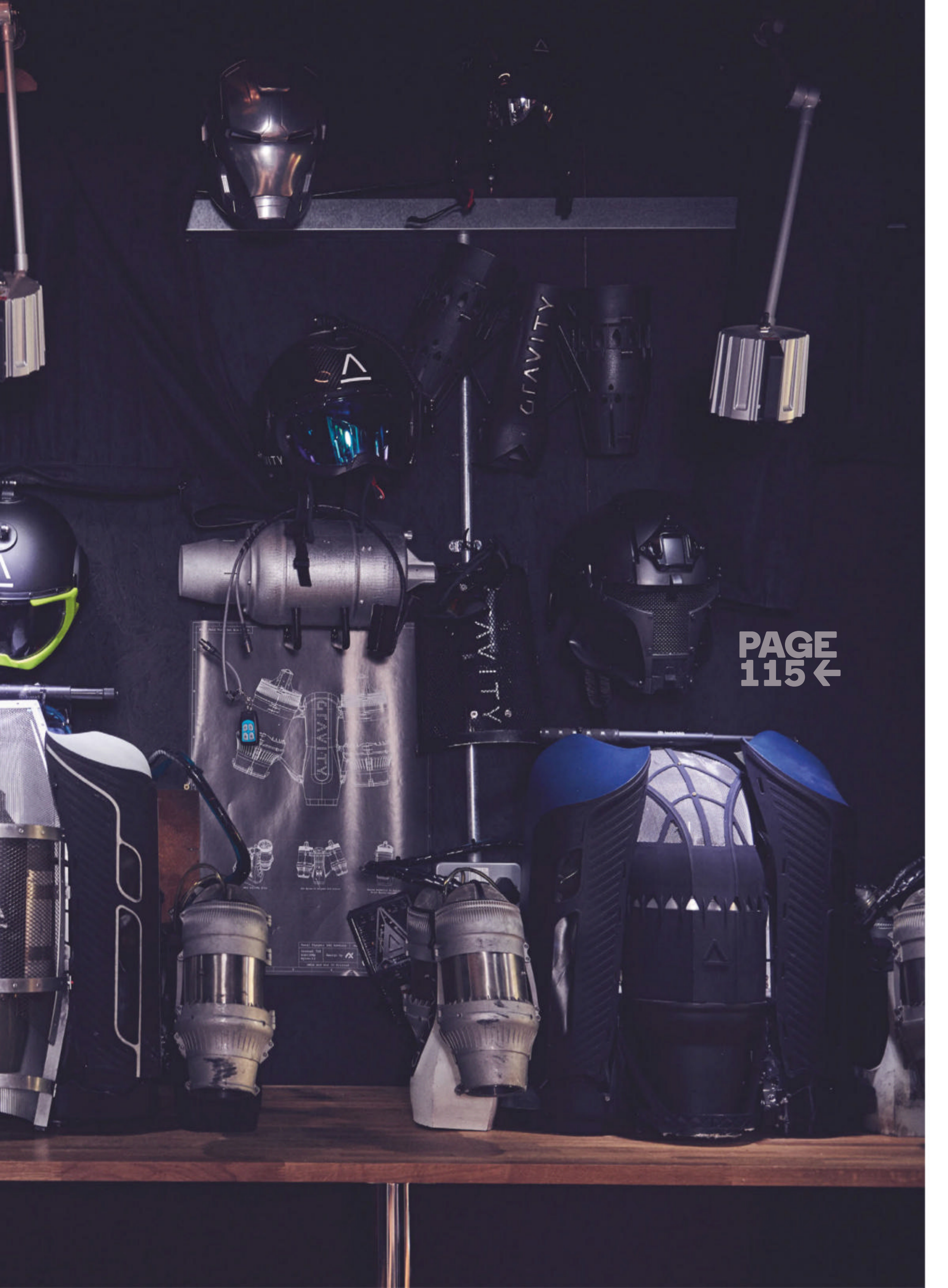




**'IT'S PUSHING  
THE LIMITS  
OF MAN AND  
MACHINE,  
FLYING LIKE  
A REAL-WORLD  
SUPERHERO'**

Potential pilots can rent a jet suit the way they might a supercar, for flying lessons in a supervised environment





PAGE  
115 ←





**In June, I visit Browning at the New Forest Water Park in Hampshire.** It's a tranquil morning: waves ripple across the water, blackbirds sing in the trees overhanging the banks. The coronavirus lockdown has eased, and Browning has come to the lake to test some alterations to the suit, and film some advertising footage for a rum brand. The pandemic,

as for so many people, upended Browning's year and his business. Most of Gravity's revenue comes from flying at live events around the world – China, Arizona, Japan – for which it charges up to £100,000, and also from flight training experiences, all of which had to be delayed or cancelled. Still, Browning says, it's not been a complete loss.



“We’ve got loads of R&D now taking place that we otherwise wouldn’t have been able to do.”

Much has changed since his first flights. For one thing, Browning is no longer Gravity’s only pilot. Today, the team is about 12 people – some full-time, some volunteers. They include engineers, former gymnasts and stunt performers; two of his team arrive at the lake wearing crew jackets from the set of upcoming Marvel Studios movie *Black Widow*. “They’re light, available, and good at following instructions,” Browning jokes. When they’re not flying jetpacks, the team members fly camera drones, capturing action-packed footage for Gravity’s YouTube channel.

The suit is also greatly improved since its early design. “The whole suit is 3D printed now,” Browning says, climbing into the back of Gravity’s mobile workshop, a converted horse box which now houses multiple suits, camera equipment and tools. “It means we can constantly iterate the designs. We’re always making them lighter, more comfortable, more compact.” The cluster of rear engines are now a single large turbine, capable of putting out 50kg of thrust. This will soon be replaced by a trio of next-generation engines, which are lighter and more powerful. “The latest iteration, sitting on my workbench, starts in ten seconds,” Browning says, visibly excited. Either side of the engine, two large white fuel bladders carry enough fuel – kerosene or diesel – for up to a four-minute flight. A heads up display inside his helmet shows the pilot altitude, engine status, fuel reserves, and current speed. Browning’s current record is 137kph.

Browning pulls on the newest addition to the suit: a pair of webbed trousers that, with his legs extended, form a tail wing. At high speed, air rushing underneath the wing creates additional lift, allowing him to fly further and faster. “The ultimate goal is you have a leg wing, and then when you open your legs, scissor out an upper body wing as well, Buzz Lightyear-style,” he says. “Now you can fly along using hardly any power, at wingsuit speeds, using 20 per cent of the fuel we do now – like a Harrier aircraft.”

He wriggles the suit’s life jacket over his head. For safety reasons, Gravity pilots fly over water wherever possible. Though Browning estimates the Daedalus will fly up to 1,800m, he has yet to exceed 10m. Above that you enter a dangerous window: too high to survive a fall, but too low to open a parachute. “Here, worst case is you’re going to fall 20 feet in the water, and need to replace an engine,” he says.

Each engine is electronically isolated, connecting to a glowing control unit on Browning’s chest; a single failure means he still has enough thrust to land. “Our ethos is we always take recoverable risk,” Browning says, clicking on the harness. “My rule is to not have my life depending on a piece of technology.”

Flight animals look unnatural on the ground. Similarly stooping under the weight of the pack and restricted by the leg wing, an ungainly Browning waddles over to the water’s edge. A proboscis holding a 360° camera protrudes out over his shoulder, and another from his helmet, giving him the look of a strange insect. Then, as he has done hundreds of times, Browning pulls the pack’s ignition trigger and the engines whirr into life. Within a few seconds the engines are at temperature, as loud as a scream, and those among the small crowd watching push in their earplugs and pull out their phones. Browning walks out on to the jetty, holding his arms out wide, the wash from the engines throwing plumes of water into the air. The birds in the canopy, no doubt unsettled by the unexpected turn of events, take flight. Then Browning lowers his arms towards the floor, and, like a gymnast rising on to the hanging rings, so does he.

of Dubai. That same year an Australian entrepreneur named David Mayman demonstrated the JB-9, his own take on the traditional jetpack design, with a flight around the Statue of Liberty. And in August 2019, Franky Zapata, a French inventor, also crossed the English Channel, standing atop a hoverboard-like device called the Flyboard Air.

The Flyboard Air is based on the Flyboard, which Zapata created in 2011. The Flyboard uses a jet ski engine to fire jets of water at high pressure, letting a person surf above the waves – a water jet pack. Zapata’s company, Zapata Racing, has sold more than 10,000 of them, chiefly to high end beach resorts and as accessories for luxury yachts. The Flyboard Air swaps the water jets for six micro gas turbines. “It’s almost like driving a jet ski, in a way, except you can’t see the waves,” Zapata says.

Each design has its advantages – and limits. Rossy’s flights are soaring, high-altitude spectacles, but his wing must be launched from an aircraft, and can only be flown by highly trained wingsuit pilots. Zapata’s Flyboard Air, although faster and boasting a greater range than traditional back-worn designs, is even more limited: only Zapata has flown it. The drag from onrushing air exerts tremendous pressure on the pilot – angled forward, he is essentially a human wing – and low level turbulence can easily throw the

board off balance. “It’s like doing a chair sit [against] the wall, but increased by ten,” Zapata says.

The cause has also faced setbacks. In 2019, Rossy resigned from Jetman Dubai after, he claims, the state stopped paying him and his team. (Jetman Dubai was asked to respond for this article.) “It’s a sad story,” Rossy says. Though he left, Rossy also claims Dubai retains the license for his original wing design, and rehired two of Rossy’s former students to continue the programme. In January 2020, one of them, Vince Reffet, performed a

vertical takeoff in the Jetman wing; although spectacular, an engine failure at low altitude would have resulted in certain death. “They put their life in the balance. That is exactly the spirit that I didn’t want to follow,” Rossy says. (“It’s so dangerous, what they’re doing,” Mayman agrees.) Rossy is now seeking funding for a new wing design.

Left: a soldering station and rack of components in the Gravity workshop, where the flight suits are custom-built. Browning’s original suit included scavenged parts from an old electric drill

**BROWNING IS NOT THE ONLY ONE TRYING TO RESURRECT THE JETPACK.**

**PAGE 117** ←

The arrival of micro gas turbines has prompted a new generation of inventors to take the idea seriously again.

In 2008, a Swiss aviator, Yves Rossy, crossed the English Channel wearing a microturbine-powered wing. Rossy, known as the “Jetman”, performs at air shows around the world, and in 2015 signed a sponsorship deal with the state



Zapata has also experienced financial difficulties. In 2016, he sold Zapata Racing to Implant Sciences, a US defence contractor, but the deal soured when a \$1.3 billion fraud case involving US hedge fund Platinum Partners had a knock-on to one of its holdings, DMRJ Group, a company which had in turn invested in Implant Sciences.

“It took me years to get out,” Zapata says. To date, R&D for the Flyboard Air has largely been funded by sales of Flyboards, but as the market becomes saturated, sales have slowed. “All of the people that dream of flying above the water have one,” he laments.

**Faced with such limitations, jetpack** startups are once again facing the same question they did in the 1960s: now that they’re here, what are jetpacks for?

An obvious candidate is military use. Browning has had interest from the British armed forces, and participated in various training exercises, landing the suit atop tanks and aircraft carriers. He foresees the Daedalus being used to launch Marines from aircraft carriers, or transport equipment rapidly across the battlefield. “The next few generations of suits will lift another 50kg, so from a military or search and rescue point of view we could travel for long distances and lift heavy things,” he says.

Mayman and Zapata have similarly had interest, and some funding, from the US and French armed forces. At last year’s Bastille Day celebrations, Zapata flew in Paris’s military parade, brandishing a rifle (empty) as he swooped in front of delighted crowds, including President Macron. Still, as yet the military interest has not solidified into orders. The jetpacks’ ungainliness, noise and short range mean that at least for now, their field potential is limited, and they have increasing competition from manned and autonomous drones.

Faced with this reality, some of the companies are now pivoting into aerial vehicles. Mayman’s Jetpack Aviation is working on a device it calls the Speeder; powered by five jet engines and with the look of a *Star Wars* prop, it promises up to 30 minutes of flight at speeds over 240kph. Zapata, too, is working to make the Flyboard Air more consumer friendly: a simplified version called the EZ-FLY – it has handlebars, like a flying Segway – will go on sale in 2021. “It’s a machine that everyone can fly,” he says. But his biggest reveal is yet to come: Zapata is also developing a prototype for a jet-powered flying car. “It’s a baby of a Formula 1 car and a racer drone,” he says. “We have no doors, We have no wheels. It’s just a seat.”



Abandoning jetpacks to build vehicles requires taking on a much larger, highly competitive market. In recent years, a host of startups have started building Electric Vertical Take Off and Landing (E-VTOL) aircraft, sometimes called flying cars. “Seven years ago there were five companies in the E-VTOL space,” Mayman says. “There’s now 240.” They include major corporations such as Airbus and Boeing, as well as tech giants like Uber, which insists it will launch a flying taxi service in 2023.

Competing with E-VTOLs also requires facing up to an awkward, retro-grade feature of jetpacks: their reliance on fossil fuels. “A lot of people are buying into the electric dream. They see the propulsion system we use as being antiquated,” Mayman says.

“We are not politically correct,” Rossy agrees.

To jetpack pilots, their reliance on kerosene is not a drawback, but an advantage. Despite the hype, E-VTOLs still struggle with limited range and long recharging times. Jet-powered VTOLs, on the other hand, could land and refuel using existing infrastructure. “Today is not a good century to fly fully electric,” Zapata says. “You can store 20 times

## ANATOMY OF A JET SUIT

1. Engine
2. Helmet with optional HUD
3. Camera proboscis
4. Electrical control units
5. Gravity flight control system
6. Power trim switch
7. Throttle
8. Fuel tanks (rear)
9. Rear engine

### SUIT STATS

**Power: 1,050bhp / Turbines: 5 / RPM: 120,000 / Fuel: Jet A1 or diesel / Weight (dry): 27kg / Flight: 5-10 mins / Speed: 136.891kph**

Above: Richard Browning wearing the V6 iteration of his jet suit, photographed by WIRED in the Gravity warehouse in August 2020



more energy in kerosene than energy in a battery. Most of the cars on this Earth are still thermic. The plane you took to go on vacation – this plane is electric? No. There is a reason for that.”

With existing battery chemistries, an electric jetpack is all but impossible. “You would need about 25kg of batteries to get about 20-30 seconds worth of flight and then land again. It would be a bit pointless,” Alex Wilson, Gravity’s avionics design lead, says. Still, the company is working to develop an electric training rig, which would be tethered to a power cable, and lower its emissions and fuel costs.

Browning is keen not to get too far ahead of himself. “I’m not trying to claim we’ve got something that is going to compete with urban mobility solutions,” he says. “Maybe it can eventually lead to that through the electric version, as battery technology advances. But it’s not that at the moment.” To date, Gravity has sold two Daedalus suits, for £350,000 each. But Browning doesn’t intend to mass produce them. “It would be very easy to hurt yourself with these if you don’t know what to do with them,” he says. Instead, Gravity now offers a membership system, similar to some supercars, where customers can pay for regular training in the suits, and fly them under supervision at specific venues. “We’re more in that world, because it allows us to protect people, and protect our brand as well,” Browning says.

The immediate future of the Daedalus is not as a consumer product, but as a sport. For the last year, Gravity has been working on a global race series, taking inspiration from the Red Bull Air Race and F1. The events will take place over water, and feature teams of two pilots competing head to head, dodging obstacles, “pushing the limits of man and machine, flying like real-world superheroes,” Browning says. The first race was to take place in Bermuda in March, until the pandemic happened. “We had everything in place,” Browning says. Covid-19 permitting, he now hopes to start the series in 2021. In the meantime, he’s focused on improving the suit.

Most of the jetpack entrepreneurs I spoke to hope that the devices will one day be everywhere. “The way I look at it, we have sedans and SUVs on the roads, just as we have scooters and bicycles,” Mayman said. Until then, their challenge is the same facing every entrepreneur: to find a market for them, so that they can continue to refine the technology. “There is a business [for jetpacks],” says Rossy. “It’s fun. You don’t need a paraglider to go from A to B. It’s just fun. I think the main business will be the fun business.”

PAGE  
119 ←

## AFTER THE TEST FLIGHT

we head back to Browning’s workshop, now its own outbuilding on the grounds of his house in Salisbury. Half a dozen iterations of the Daedalus hang on the walls, and here and there are little mementos: *Iron Man* memorabilia, event lanyards, clippings of articles. Near his desk hangs a cluster of family photos, and a large illustration of Browning’s father pedalling a kind of paraglider – the inventor in flight. “I’m reliving the pathway that I saw my father try and run down,” Browning says. “I think that’s part of why I keep finding myself in these weird realms, because I felt we were so close, and my father was so close, and he never quite got there. I’m trying to relive and make good that terrible story.”

There’s no doubt that Browning has built something remarkable, but he’s sanguine about Gravity’s prospects. “Sadly, [my father] taught me one of those valuable lessons the hard way about never getting too carried away. This could all be nothing in a year’s time,” he says. “There’s no rulebook on how we build this business, let alone with the outside world now moving around in a totally unpredictable way.”

“But I do have to think, gosh, but I am doing something which is so close to what he would love.” Browning carries his gear back in from the truck, tosses it in, and leaves for lunch with his family. ▣

Oliver Franklin-Wallis wrote about  
Google X in WIRED 03.20



THE PANDEMIC  
HAS CREATED A GLOBAL  
ECONOMIC CRISIS-  
BUT ALSO OPPORTUNITY  
FOR CHANGE. HERE,  
SEVEN ECONOMISTS  
SHARE THEIR LONG-TERM  
SOLUTIONS FOR  
A BETTER FUTURE

# FIXIN' POST- ECON

A GREEN  
NEW DEAL!  
UNIVERSAL  
BASIC INCOME!  
RE-IMAGINING  
CAPITALISM!



# GET THE -COVID OMY

SEVEN ESSAYS FROM:  
REBECCA HENDERSON,  
DIANE COYLE, RHIANA GUNN-  
WRIGHT, YANIS VAROUFAKIS,  
JOELLE GAMBLE, GUY  
STANDING & RICHARD DAVIES  
PHOTOGRAPHY: BENEDICT  
EVANS & NICK WILSON  
LETTERING: NEW NORTH PRESS



# BUSINESS MUST DRIVE POLITICAL CHANGE

CAPITALISM IS BROKEN. INEQUALITY has reached levels not seen since the Gilded Age. Social mobility is falling. The novel coronavirus pandemic has highlighted the fact that far too many “essential” workers have no sick leave, no health care and no savings. Climate change remains a clear and present danger.

All too often these are seen as problems for government. But my research suggests that the private sector can – and must – play a central role in driving the systemic change that is the only lasting answer.

Many firms believe that their only responsibility is to maximise profits. But the bedrock values of modern capitalism are prosperity and freedom, not profitability for its own sake. Genuinely free and fair markets are one of our great inventions – yet markets are only genuinely free and fair when externalities such as pollution are properly priced, when governments provide the public goods on which true equality of opportunity depends, and when firms can’t fix the rules of the game in their own favour. When the social costs of burning fossil fuels remain unpriced, when those born in the wrong place to the wrong parents have less than half the chance of moving up the ladder than those born elsewhere, and when the rich shape the rules of the game to their advantage – then there is no guarantee that markets will generate either prosperity or freedom.

It is essential that business play a role in rebalancing our institutions. It’s going to be hard to make money in a world in which the major cities are underwater, crops are failing, and millions of people are trying to move north. Rising inequality, and the political anger it creates, is destabilising political systems. Populism can be a powerful force for reform but it risks sanctioning tyranny. And tyranny has never been good for business.

Co-operating in the interests of the long-term common good is not natural for many firms, but it is possible: the major buyers of beef and soy came close to halting deforestation in the Amazon – progress that is, alas, being reversed by the Brazilian administration. Collective action by the major apparel buyers has led to improvements in working conditions in many supply chains. The largest firms in these industries realised that doing the right thing was in their best interests – but everyone in the industry had to agree to do it. It can be hard to pay a little more for sustainably produced beef if one’s competitors are willing to look the other way.

Better indicators for material non-financial performance – so-called “ESG” (environmental, social and corporate governance) metrics – could be another tool for supporting co-operation. The world’s largest asset owners are “universal investors”, who have so much money that they are effectively forced to hold the whole market. The Japanese Government Pension Fund, for example, has about \$1.6tn under management and owns about one per cent of the world’s equities. The largest asset managers are even bigger: Blackrock has about \$7tn under management, while Vanguard holds

more than \$6tn. For universal investors climate change and inequality are not externalities, but threats to future returns. That is why large asset owners are already beginning to push the firms they own for change. Climate Action 100+ counts more than 450 investors among its members, who between them control more than \$40 trillion in assets. Material, replicable, auditable ESG metrics could plausibly enable these kinds of investors to insist that every firm in their portfolio begin to make progress against the big problems.

Could firms also help to address the political problems we face? Strengthening our democracy will require co-ordinated action – every individual firm has incentives to take advantage of our current weakness – but we already have the kinds of associations that might take a leadership role in partnering with civil society to push for reforms like pulling money out of politics and actively moving against voter suppression.

I know how unlikely this seems. For far too many people, business is the problem, and the suggestion that the private sector should play a leading role in rebuilding our democracy sounds like an invitation to crony capitalism. But our situation is critical. We must find a better way forward – or we risk losing the whole game.



Rebecca Henderson is John and Natty McArthur University Professor at Harvard University and author of *Reimagining Capitalism*



THERE IS NOTHING LIKE THE BIGGEST economic crisis for 300 years – not to mention months of lockdown – to raise some fundamental questions. Why are “key workers” some of the worst-paid people? Why are airlines but not freelancers in the arts getting government bailouts? Why was the health service so badly underfunded even before this pandemic?

The Covid-19 recession is exposing weaknesses in the economy – while also revealing just how much governments can intervene in the economy if they want to. So the question is whether the

Economist Diane Coyle photographed by WIRED in London, August 2020

economy was in all that great shape to begin with. And if not, why can't governments change the way it operates?

There has been growing discontent about growth in Gross Domestic Product (GDP) as the measure of progress. It excludes the way nature is affected by production and consumption. It excludes unpaid work such as childcare. It ignores how the top ten to one per cent have seen substantial increases in their incomes, while those of the rest have barely grown.

Economists and statisticians have also been trying to improve the measurement of the digital economy. Tech-driven changes mean that measures of price inflation may miss

Diane Coyle is the Bennett Professor of Public Policy, University of Cambridge

the many free apps people use – such as taking photos on a smartphone and sharing them online rather than buying a camera and paying for developing and printing. Yet the digital economy is also helping drive inequalities of wealth and power, reshaping politics and disrupting industries and jobs.

The pandemic is giving these debates new urgency. If we had been using a lens other than conventional GDP growth during the past decade, we would have been aware of the big differences in income growth between places or groups. We would know how far we have run down the country's natural capital to sustain lifestyles by destroying biodiversity and altering the climate. We would be more aware of the massive transformation in people's everyday life and in business models thanks to digital platforms.

So it is no wonder that the appetite is there for a far broader understanding of what is meant by the “better” in the ‘build back better’ slogan. Recent polling suggests almost a third of Britons think the government should make big changes in the way the economy is run, and another 28 per cent would like moderate changes.

This is far from a consensus about change, but the fundamental sense of unfairness is palpable. Whatever we mean by the economy growing, by things getting better, the gains will have to be more evenly shared. In particular, the new technologies transforming life will need to bring wider benefits. An economy of tech billionaires and gig workers, with middle-income jobs undercut by automation, will not be politically sustainable. Medical innovations from 3D-printed organs to personalised cancer treatments cannot be only the preserve of the super-rich.

The tech-driven inequalities had already disrupted politics in many countries by destabilising the solid middle. Let's hope Covid-19 can ensure that lasting change comes about, or we may be in for a revolutionary period.

# GROWTH IN GDP IS A BROKEN MEASURE



# GO GREEN TO BEAT INEQUALITY

AS THE ECONOMIC IMPACT OF COVID-19 rages on around the world, stimulus funding is still needed in the US and Europe, both to provide immediate relief and to drive an economic recovery that countervails the recession triggered by the pandemic. However, the question remains of how to initiate and sustain that recovery, especially since we will likely not know the full extent of the recession nor the full economic impact of the coronavirus for years. Investments in decarbonisation and clean energy – what I refer to as green stimulus – offer a compelling path forward.

Elected leaders have the responsibility to rebuild the economy; they also have a unique opportunity to advance a justice-driven approach that invests in working people, builds strong communities, and reduces inequality – investments long needed to end the decay of our global economy. But if the stimulus packages passed thus far are any indication, we may not only miss that chance completely, but also jeopardize any hope for a full recovery.

In the United States, stimulus funding appears to be climate-neutral: the CARES Act – the major stimulus package passed in response to the coronavirus pandemic – does not explicitly benefit either clean energy or fossil fuel companies. However, after intense lobbying from fossil fuel advocates, the Federal Reserve loosened eligibility conditions for the emergency “Main Street” lending programmes to make it easier for oil and gas companies to receive loans and to use them without restriction.

Europe has taken a decidedly more green approach to economic stimulus. For example, the EU has committed to allocating 25 per cent of its proposed economic recovery package – more than €188 billion (£170 billion) – to decarbonisation measures including sustainable land use. Several EU member nations have also designed national recovery packages that

provide additional green stimulus measures, including €4 billion for green renovations to social housing in Denmark and €41 billion to support low-carbon transportation and energy alternatives in Germany.

For its part, the US could recognise this moment for what it is and work to craft stimulus packages that address two existential crises at once: Covid-19 and the climate crisis.

It is, however, unlikely that even Europe’s proposed green investments will reduce emissions or realign markets enough to sufficiently offset the uncertainty caused by climate change or the coronavirus – especially since non-climate spending dwarfs climate spending at least 3:1, even in the most climate-friendly recovery packages. Furthermore, without strong supporting policies – such as climate finance reforms and investments in

marginalised communities – it is unlikely that green stimulus policies as proposed thus far will lead to more equitable and just societies, let alone a lasting economic recovery.

Green stimulus programmes have the power to spark a private investment boom as technological change and transformations in the market encourage productive new investments. If designed correctly, green stimulus policies can help address the structural causes of the current economic collapse, while averting an even bigger climate crisis. It has never been more timely, more appropriate, or more possible to make green jobs a driver of good jobs that provide health benefits, paid family leave and a living wage.

While climate change is not an acute crisis like Covid, it holds the seeds of many other similarly acute and damaging crises, including future pandemics that will arise from changing land use and shifting disease vectors – each with the potential to catalyse sustained economic damage. To ensure a resilient future, we need bold, intersectional action today.

Rhiana Gunn-Wright is director of climate policy at the Roosevelt Institute





IMAGINE THAT THE BANK OF ENGLAND were to create a free bank account for everyone. Overnight, it would be far better placed to regulate the money supply in the public interest. Moreover, to stay in business, commercial banks would have to seriously raise their game.

In times of trouble, such as the current novel coronavirus pandemic, the Bank of England could lift all boats at once by crediting your account directly – instead of printing sterling to lend to commercial banks, as it does now, in the hope that they would then lend to your employer, in the hope that your employer would then invest the money, rather than buy back more of their own shares. And, if the Bank of England felt that it had to rein in the total supply of money to avert inflation, it would be able to do so easily: just offer to pay you, say, £5 for every £100 in your account that you do not spend within the next 12 months.

Imagine further that the Bank of England, in a bid to promote trust via transparency, were to base its digital sterling ledger on a distributed ledger digital architecture that allowed everyone, in real time, a glimpse at how much money was sloshing around in its financial system.

Now imagine that the Bank of England were to lend its expertise to local authorities around the country to revive their regional economies by creating local

digital currencies for the purpose of keeping within their communities as much of the surpluses produced locally as possible. These currencies would be backed by their capacity to pay local taxes and their free-floating exchange rate with sterling would be determined automatically by a transparent formula taking into account the balance of payments between the regions.

Imagine, also, that the Bank of England were to come to an agreement with the central banks of other major economies, reflecting a New Bretton Woods-type of international agreement that allows for global trade imbalances and climate change to cancel each other out. This unlikely feat could be accomplished in three steps:

First, central banks agree to create a digital accounting unit, let's call it the Kosmos or Ks, in which all international trade and cross-border money transfers are denominated (with a free-floating exchange rate between national currencies and Ks).

Secondly, they also agree to charge symmetric levies upon net exporters of goods and money (a trade-imbalance levy and a surge levy) that help stabilise world trade and global money flows.

Thirdly, the proceeds from these levies fund climate change mitigation projects, especially in the global South.

For example, if the US-German trade is grossly imbalanced, both Germany and the United States are charged the trade-imbalance levy: a certain number of Ks are withheld from the German central bank in proportion to Germany's trade surplus with the United States,



Yanis Varoufakis is a member of Greek parliament and leader of the MeRA25 party

and another number of Ks is withheld from the United States in proportion to America's trade deficit with Germany. By taxing symmetrically trade deficits and surpluses, powerful market incentives help diminish global trade imbalances.

The second levy proposed is charged to speculative capital flows into, and then out of, developing economies; capital movements that cause bubbles to inflate, distorting economic activity, before bursting with hideous effects on the local economy. This surge levy is proportionate to the acceleration of capital flows into, or out of, every country.

Thus, the world will have agreed to strong incentives to limit trade and money transfer imbalances by levying penalties which, on the one hand, balance the current and the capital accounts of major economies while, on the other, help fund green investments, renewable energy grids, transport systems and organic agriculture in the parts of the planet most needed.

If these gains are so easy to attain, what stops us? Simple. These innovations would wreck the capacity of financiers to usurp the gigantic rents they currently extract from our societies. Our problem is political, not technical.

# CENTRAL BANKS CAN REBALANCE GLOBAL TRADE







# WORK ISN'T ONLY ABOUT PAY

NO ONE SHOULD HAVE TO CHOOSE between staying healthy and going to work. Yet, this summer, at the height of a pandemic that had claimed more than 150,000 American lives and paralysed the US economy, Congress was debating whether to extend expanded unemployment insurance (UI) benefits for millions who had lost their jobs. Republicans claimed that \$600 in additional weekly payments, which is more than some workers were earning, deterred people from seeking work. Putting aside that this expanded UI programme was only implemented because of a pandemic – and millions of Americans cannot and should not go back to work until it is under control – this argument is based on a flawed assumption: that higher wages are the primary incentive for people to work.

Unemployment benefits help the economy. Each dollar of UI raises aggregate economic activity by \$1.10, meaning that for each dollar of UI spent, it supports an additional ten per cent increase in economic activity. That keeps the economy growing and keeps millions of other Americans employed – retail supports one in four American jobs.

This effect is critical right now, with the US facing both supply and demand pressures on the economy. To keep Covid-19 from spreading, businesses had to close. As a result, people were laid

off and consumer spending plummeted. Families have been using their UI for rent and groceries, keeping consumer demand from falling through the floor.

Republican lawmakers argue that if Congress continues to offer generous UI benefits, firms would be forced to offer wages that are higher than these benefits to entice people to return to work. But new research casts doubt on the claim that UI has a significant effect on wages. Other studies have shown that when workers do find jobs, UI has little influence on their ability to bargain for wages. There is some evidence that the duration of UI can affect how long someone remains unemployed, but a recent study found that workers collecting unemployment benefits search twice as intensely for a job as those who have lost their benefits. These workers are using the peace of mind UI provides to find better jobs, not stay at home.

What really motivates people to work is a job that gives them dignity – a workplace where their contributions and their voice matter. The Omidyar Network teamed up with Gallup and other organisations to survey over 6,000 workers to find out about the quality of their jobs. And we found that while people certainly care about pay, it is not the only factor.

Other countries are modelling what a recovery that moves beyond dated economic assumptions can look like. As the pandemic got worse, Denmark effectively froze its economy, paying companies to send employees home but keeping them on payroll. They've avoided multiple rounds

of layoffs – and maintained workplace quality by keeping companies connected to their employees. As a result, Denmark has reopened and is back to normal employment. Germany worked with firms and employees to prevent mass layoffs by subsidising workers' pay. As a result of this forethought, both Denmark and Germany appear poised to emerge from the economic crisis in a much stronger position than the United States.

US lawmakers should continue to provide ample benefits for workers hurt by this pandemic, while also focusing on both improving the quality of workplaces and ensuring workers have a voice within them. That means supporting work councils, sectoral bargaining and union organising, which improves wages and benefits for employees at scale and gives workers a seat at the table when it comes to setting the health and safety standards that are designed to protect them.

If the United States is ever to achieve the faster economic recovery that other advanced nations are enjoying, lawmakers must recognise that for most Americans, work is about so much more than a paycheck. Understanding this will allow us to avoid outdated policies, hasten the recovery, and build a better labour market once this crisis finally passes.

Joelle Gamble photographed for WIRED by Benedict Evans at Gamble's home in Washington DC

Joelle Gamble is a principal with the Reimagining Capitalism team at Omidyar Network



# WE NEED A NEW INCOME DISTRIBUTION SYSTEM

COVID-19 WAS THE TRIGGER FOR AN economic collapse – but it was one that was waiting to happen. There will be other triggers. The challenge is to build a new income distribution system that will provide society, and every individual, with much greater resilience.

What has produced the fragility, in Britain and globally, is the evolution of rentier capitalism, in which more and more of the income flows to owners of financial, physical and so-called intellectual property. In the UK, the value of financial corporations' financial assets has risen to over 1,000 per cent of GDP. Meanwhile, private riches have risen from about 300 per cent of GDP in the 1970s to 700 per cent today – and wealth inequality dwarfs income inequality, with over 60 per cent of wealth inherited.

It is essential to dismantle rentier capitalism. But that must be done in a way that weakens what I have dubbed the Eight Giants blocking the path to a Good Society for the 21st century. In 1942, in an epoch-defining report, William Beveridge said it was “a time for revolutions, not patching” and that the challenge was to slay Five Giants – Disease, Ignorance, Idleness, Squalor and Want.

We have not yet defeated those adequately, but the modern Giants of Inequality, Insecurity, Debt, Stress, Precarity, Automation, Extinction and Neo-Fascist Populism also need attention. Unless policies weaken their threats, there will be no resilience for next time.

No policy is a panacea. But whatever is proposed must weaken some of those Giants and not exacerbate others. In a transformational moment, a new income distribution system is needed, because the one on which 20th century economies were based has broken down. The share of income going to labour has declined globally. If we could recognise that this will persist, we could think more constructively about what to do.

Two changes are essential. We must revive the commons, historically “the poor's overcoat”. Natural commons belong to us all; social commons are the institutions and services bequeathed to us: the NHS, social housing, refuges, libraries, parks and so on; civil commons are institutions assuring equal justice; cultural commons are our arts and cultural institutions; knowledge commons are our shared access to information, ideas and education. All were shredded by privatisation, austerity and financialisation in the decades of rentier capitalism. That increased social inequalities and made society more fragile.

Second, a basic income system has moved from being ethically desirable to being an economic imperative. We should remind ourselves that the resilience of all will depend on the resilience of the most disadvantaged in society.

If every individual had equal basic security, that would be common justice. Our collective wealth and income are far more due to the efforts of the many

generations before us than to anything we do ourselves. If we allow private inheritance of “unearned” wealth, we could interpret a modest equal basic income as social inheritance, a social dividend accessible to all.

A modest basic income is affordable, and in the longer term could be funded by building a Commons Capital Fund, based on levies or taxes on all incursions into our commons, in which as the Fund grows, through making ecologically sustainable investments, the value of the Common Dividends, or basic incomes, could rise. We are talking about being on a road, not an overnight solution. A basic income system would have many positive effects, reducing the sadness of stress and insecurity, and the life-shortening health problems they induce.

If the Fund were built partly by eco-taxes, such as carbon tax, and led to basic incomes regardless of work status, that would allow all of us more time for care and ecological work, less to resource-depleting labour in “jobs” – just what most of us would wish to do.



Guy Standing is a founding member of the Basic Income Earth Network, a non-governmental organisation



COVID-19 IS A SHOCK THAT HAS SWEEPED the world. Yet as governments focus on the pandemic, we are quietly hurtling towards a new destination – the “hyper-aged society” – which will bring new tensions between health, economics and politics. With almost all economies on the same path, we should be looking to the leader of the pack, Japan, for clues to the future.

Two thrusters are propelling us towards economic systems defined by old age. The first is that we are seeing more extremely old people. In 1963, Japan started collecting data on 100-year-olds, with government statisticians finding 153 of them. By 2040, it's predicted there will be over 300,000.

Ultra-long lives combine with the second thruster – falling birth rates. In 1920, the average Japanese woman had five children; today, she has around one. With more old people, and fewer young ones, a country's average age shoots up. This trend is global, and many countries are tracking Japan.

Richard Davies photographed for WIRED by Benedict Evans in Bristol, near Davies' home in August 2020

# AGE: THE NEXT GLOBAL HEALTH CRISIS

An elderly society is a sign of fitness, economic and social – but elderly societies become frail. The most obvious pinch points are rising pension and healthcare costs. In the UK, more than 89 per cent of deaths due to Covid-19 have been in the over 65s. In Akita – a hyper-aged region of Japan – more than a third of people are already over 65. The budgetary costs of keeping people healthy rise sharply.

The frailty is not just economic, but social. Japan is famed for its family structures and respect for the elderly. Yet on the ground in Akita city and Tokyo, things aren't so rosy. The term *sedaikan kakusa* or “intergenerational inequality” comes up a lot, as those

under 30 wonder why they are propping up pension payments and hospitals to cater to the elderly. A world with pandemics ramps up these costs and undermines young people's freedom to congregate and their ability to work.

Cities tend to lead, but the final stage of the ageing trend will start in small towns and villages. As young people migrate to urban centres, communities are appearing that are almost exclusively elderly. By threatening the old and isolated, Covid-19 and any pandemic like it could intensify a bizarre phenomenon – the disappearing town. Travel through rural Japan and you find countless *akiya* (“ghost houses”) along with deserted schools, village greens and markets. This is the final step in the life-cycle of the ageing society: first small towns got fitter, now they are frailer, and soon they will disappear.

This journey brings challenges we have not seen before. Take a vital economic market like housing. There are an estimated eight million ghost houses in Japan. With such plentiful supply we might expect a slump, but something new and extreme happens: in a vanishing village there is no price, however low, at which people will buy. The market is not depressed, but frozen. This chill goes further than economics: when a town is disappearing, local politics becomes pointless: across Japan, one-fifth of seats in the 2015 local elections went uncontested.

The solution to these problems will need to be extreme: bulldozing unwanted properties, rewilding deserted areas, and finding new ways to engage rural voters and politicians. Ageing is itself a pandemic, one that we will need to begin tackling as soon as Covid-19 is under control. [W](#)

Richard Davies is an economist and author. His book, *Extreme Economies*, is published by Penguin









**THE GLOBAL PANDEMIC HAS CREATED AN OPPORTUNITY TO RE-IMAGINE HOW URBAN ENVIRONMENTS SHOULD WORK - FROM ROADS TO BUILDINGS TO BUS STOPS. BY WILLIAM RALSTON**

The global pandemic has created an opportunity to re-imagine how urban environments should work - from roads to buildings to bus stops. By William Ralston



# AS

**a pedestrian in an urban environment, your life is subject to near-constant danger from every direction. There’s an 80 per cent chance that the air you’re breathing doesn’t meet the World Health Organization’s recommendations on pollution and, despite decades of improvement, roads are becoming more perilous. Cities are also damaging on a macro scale: according to the United Nations, they consume 78 per cent of the world’s energy and produce more than 60 per cent of greenhouse gases.**

**Seeking change, urban planners have shown that small tweaks to roads, buildings and public spaces can have an outsize effect on the way citizens move and live. Looking ahead, the disruption caused by Covid-19 presents a unique opportunity to re-evaluate our cities. With people indoors, global authorities have taken the opportunity to reconfigure streets to prioritise pedestrians and unravel an auto-centric culture that has defined city life for decades.**

**“It’s really interesting to see what can happen if you look at your streets a little differently,” says Janette Sadik-Khan, a former commissioner of the New York City Department of Transportation. “The possibilities have been literally hidden in plain sight – and you can see them now. These empty streets provide an outline for the city you want to see.”**

**Here are some of the trends and innovations trialled by cities around the world that could define the future of urban spaces that are built around humans, not vehicles.**

## SMART ROAD CROSSINGS

**The crossing has been** preparing for you before you set foot on it. Radar and thermal cameras detect your approach and notify a central control system, which triggers rows of LED warning lights on either side of the walkway to alert approaching drivers. The system sounds an alarm as you cross, and projects a warning image on the ground in front of you, while also flashing up on your smartphone. As the driver comes within 30 metres, a blinking electronic sign highlights your crossing.

This type of pedestrian crossing is in three locations across South Korea, and was designed by the Korea Institute of Civil Engineering and Building Technology (KICT). It aims to minimise road traffic accidents in response to rising pedestrian casualties, 52.9 per cent of which occur at crossings. Many of these are caused by people crossing while looking at their phones (South Korea has the world’s highest smartphone penetration, and some of the highest road fatality and injury rates among developed countries). “I came to think of a smart crossing system that recognises the urgency of pedestrian safety,” Kim Jong-hoon, a senior researcher at KICT, says.

In tests, 83.4 per cent of vehicles reduced their speed by an average of 20 per cent – a result that Jong-hoon believes can drive wider rollout and eventually a tapestry of intelligent crossings that will communicate with one another. “We hope that the

smart pedestrian safety system will evolve into a co-operative network of AI-enabled entities working together,” he says.

Jong-hoon is not alone in his quest to redesign the road crossing. Traffic accidents often occur while pedestrians are crossing the road, and traditional crossings – on set timings or activated by a button – create delays and pollution.

Vienna has rolled out four smart crossings engineered by the Graz University of Technology that employ cameras and deep-learning algorithms to anticipate a pedestrian’s trajectory. If someone appears likely to cross, the system halts traffic, thereby minimising wait times to discourage people from crossing before the light has changed. It cancels the walk-light if the pedestrian walks away, and adjusts the walk-light’s timing according to the number of people crossing.

In the UK, Transport for London (TfL) is trialling crossings that show a continuous green signal for pedestrians – until they detect a vehicle. The length of the green man phase increased by more than 20 seconds at one site, giving disabled and elderly people more time to safely cross.

TfL is also working on a central control system, like the one envisaged by Jong-hoon, which connects individual junctions and regulates the traffic flow through the city. Zürich, in Switzerland, is a step ahead with its integrated model, which adjusts signals at the city’s perimeter depending on feedback from inside.



## ECO BUS-SHELTERS

**'THERE'S A PERCEPTION THAT ALL ROAD SPACE IS A ZERO-SUM GAME: IF WE GIVE SPACE TO CYCLISTS, THEN YOU MUST BE TAKING IT AWAY FROM SOMEONE ELSE'**

For many urban road networks the signal systems that determine traffic flow "do not respond as they could and should to network demands in real time," says Isabel Dedring, former deputy mayor for transport in London and currently global transport leader at design and engineering giant Arup. If you imagine traffic

as water, we're not using the pipes efficiently because the valves are not synced; some pipes flow freely, others clog. With better flow-timing, we can create additional time across the network, she says.

Network-wide, real-time management could prove key. "People know we need to pedestrianise streets, but there's a perception

that all road space is a zero-sum game: if we give space to pedestrians and cyclists, then you must be taking it away from someone else," Dedring says. "If we can create more space in the pipe through more efficient systems, we can allocate it to cyclists and pedestrianisation without having political arguments."

Bus stops have gone through many iterations since their proliferation in the 1960s. Some of them are nothing more than a glorified phone-signal mast, while others have real-time information screens and even feature integrated public toilets. Now, cities are sizing the opportunity these bite-sized pieces of urban real estate offer, turning them into sustainable smart hubs that respond to customer queries and traffic conditions while offering a suite of extras.

Paris has unveiled bus stops installed with mobile phone charging and interactive maps, and fitted with solar panels. A similar model exists in Barcelona. In Singapore, city officials have piloted the Airbitat Oasis, which automatically adjusts its sustainable cooling cycle based on the surroundings and the number of people. Cameras detect suspicious activities and a filtration system traps debris and dirt, while also providing commuters with real-time data on air pollution levels.

Poland has more electric buses than any other European country, but 80 per cent of the energy needed to power them comes from coal. Officials in the city of Rzeszów have rolled out 140 eco-friendly bus shelters with solar technology. The main bus station is covered with photovoltaic cells that allow for ventilation while collecting energy. Combined with a heat exchanger, the buildings are zero-energy; excess power produced goes to the electric bus fleet and nearby buildings.

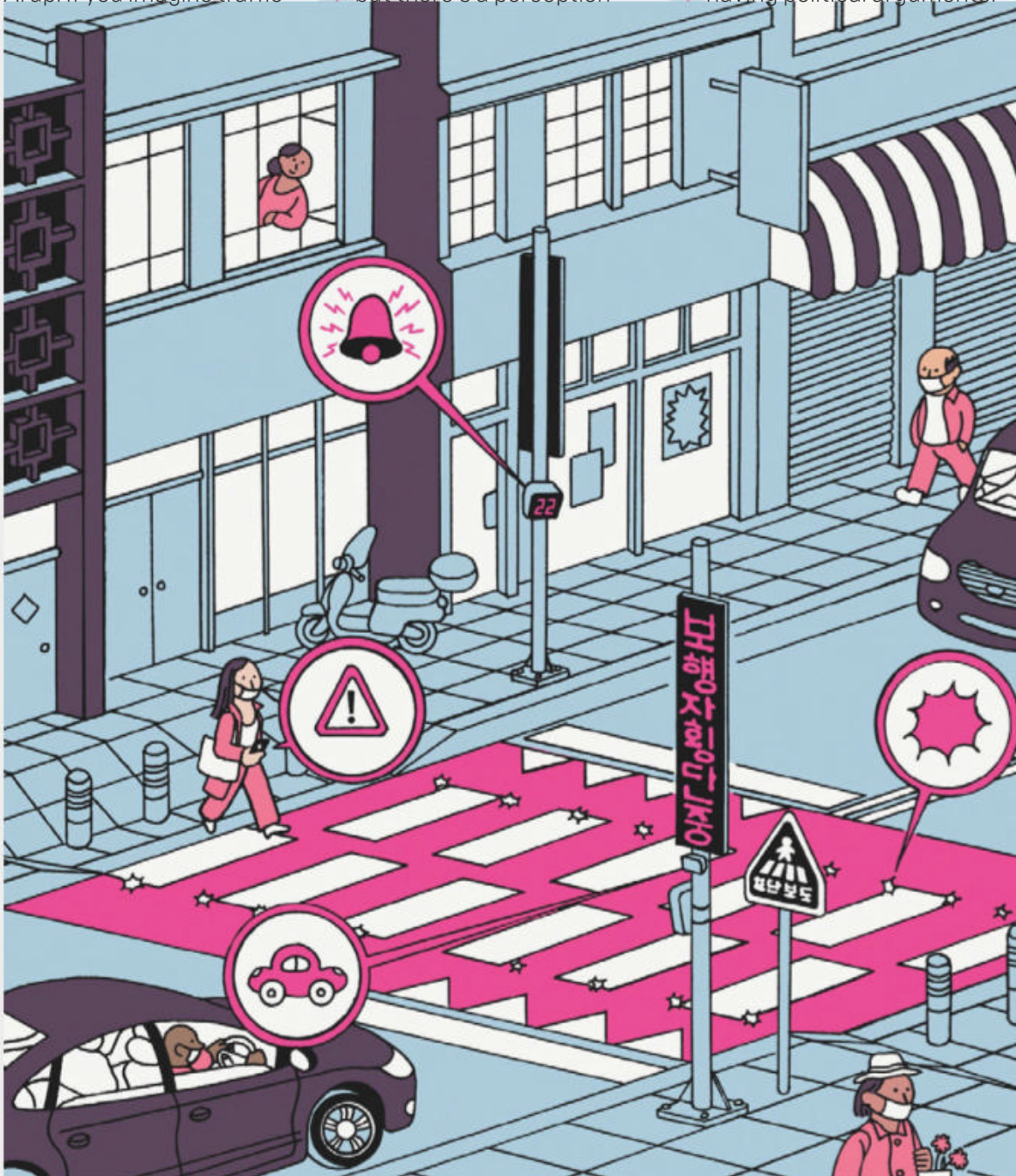


ILLUSTRATION: OPENER: JEROME NG XINHAO. THIS PAGE: PETE GAMLEN



**Pedestrians using smart crossings in South Korea get reminders to stay alert sent direct to their smartphones**



**As drivers get closer to the smart crossing, a blinking sign warns pedestrians of their proximity**



Copenhagen's cyclists are made to feel safer with special lanes and traffic signals



3

COPENHAGEN, DENMARK

## BIKE-FRIENDLY DESIGN

**Cyclists in Copenhagen, Denmark, pedal an estimated 1.4 million kilometres per weekday, not just for environmental reasons, but because it's the easiest way to cross the city. Assisted by the area's naturally flat terrain, officials have built an infrastructure that encourages and rewards cycling.**

The city has 380 kilometres of dedicated bike tracks, which are a minimum of 2.2 metres wide in each direction (three metres is the standard on the busier streets) and separated from the road and pavement by a kerb on either side. Traffic lights are synchronised with the average speed of cyclists to keep cycle traffic flowing, and have a "pre-green" light to give cyclists a five-second head-start over cars at junctions or crossings. Cyclists also benefit from cyclist-only bridges and superhighways that provide traffic-light-free travel between the city centre and neighbouring municipalities. "Our main principle is physical separation; paint is not enough," says Marie Kastrup, head of Copenhagen's Bicycle Program. "You have to put yourself in the mind of someone who is not a confident cyclist."

City planners elsewhere are looking to Copenhagen as they encourage cycling in their fight against congested roads and carbon emissions. In 2019, New York passed legislation requiring 400 more kilometres of protected bicycle lanes (bike lanes that are physically separated

from traffic) to be built over five years, and London's protected cycling infrastructure has doubled in size since 2016. Oslo has uprooted large sections of the city to replicate Copenhagen's design in accommodating cycle lanes and, despite the heat, bike trips in Seville, Spain, multiplied 11-fold after city officials laid down 80km of protected lanes in the early 2000s. Lisbon has shown that cycling can even work in hilly cities, thanks to carefully planned routes and electric bike rental.

"The bike is not an over-hyped, new technology like the autonomous car or hyperloop, and we are seeing more cities making it work in different contexts," James Thoem, an urban planner at Copenhagenize Design Co., says.

For people to cycle, Thoem says, they must feel "safe across the whole journey – not just corridors here and there." He describes some current cycle schemes as like a subway network with disconnected lines in different areas of the city. "Nobody would use this, because it wouldn't take them anywhere," he says. "It's not until you have a connected network that people will see that as a legitimate option."

Objections are often raised to the installation of cycle routes because they are perceived to be reducing the finite amount of road space for drivers. Dedring, global transport leader at design and engineering giant Arup and former deputy mayor for transport in London, says that a cultural shift within agencies may need to happen to encourage cycling. "For public transport agencies, people moving on buses and trains is a source of fare revenue, whereas walking and cycling can be seen as a direct threat because it's free and hence doesn't generate fare revenue," she says.

Covid-19 may expedite the transition to cycling. To maintain the reduction in air pollution and lessen crowding on public transport, France has been subsidising bike repairs and Paris has been building cycle routes along its three busiest Metro lines. The UK government hopes to do the same by investing £250m in pop-up protected bike lanes across England, while also fast-tracking e-scooter legalisation; and Brussels is transforming 40 kilometres of car lanes into cycle paths. "I have no doubt that this is where we will end up," Dedring says. "The question is the pace and the trajectory that will get us there."



PEDESTRIANISATION

**In 2019, Oslo in Norway** recorded zero pedestrian or cyclist deaths. The only traffic fatality involved someone driving into a fence. (For comparison, preliminary figures in London show 73 pedestrian and six cyclist fatalities in 2019; New York recorded 218 total traffic fatalities, including 121 pedestrian and 28 cyclist deaths.)

Oslo’s achievement means that it is just one step away from “Vision Zero”, an undertaking to eliminate all deaths on public roads. The foundation for achieving this is to significantly reduce the number of cars on the road. Oslo officials have removed more than 1,000 street-side central parking spots, encouraging people to lean on an affordable and flexible public transport network, and added more bike lanes and footpaths. Significant areas are closed off to cars entirely, including “heart zones” around primary schools. “The wish to pedestrianise the city isn’t a new policy, but it has accelerated now,” Rune Gjøs, a director at Oslo’s Department of Mobility, says. “The car became the owner of our cities, but we’re resetting the order again.”

Despite its success, Oslo’s initiatives have faced opposition from some people who don’t know life without private cars. There’s also a misconception that pedestrianisation hurts local trade, because the data has always been “patchy,” says Harriet Tregoning, director of the New Urban Mobility Alliance, a global group helping cities to integrate more sustainable

transportation. But Oslo’s success contributes to a growing body of evidence that pedestrianisation not only saves lives, but is good for business. After reducing cars, footfall in the centre increased by ten per cent.

“The city centre is thriving and top-brand shops want to establish themselves on the car-free streets,” Gjøs says. “This shows that consumers find these streets attractive, and they’re leaving as much money behind as if they were coming by car.” Demand for

residential real estate has also increased, due to lower levels of traffic and pollution.

“It used to be that people take their families out of the city on the weekends, but now people are coming into the centre,” Hanna Marcussen, Oslo’s vice mayor for urban development, says. “They’re using the centre as a place for activities, not only shopping and business.”

The disruption caused by Covid-19 has catalysed pedestrianisation projects elsewhere. Cologne in Germany and Calgary in Canada are among cities that have closed off large areas to through-traffic to allow more room for pedestrians to social

distance. City officials in Bogota, Colombia have extended its car-free Sundays to the whole week, and Paris mayor Anne Hidalgo has banned private cars from the iconic Rue de Rivoli. Hidalgo has said that returning to a Paris dominated by cars after lockdown ends is “out of the question”. Milan will pedestrianise 35 km of roads indefinitely.

Rather than totally eliminating cars – the disabled and elderly, for instance, sometimes rely on cars for mobility – it’s likely that cities will seek to develop public transport and set aside more designated areas for pedestrians.

Janette Sadik-Khan refers to this remodelling as rewriting the operating code of the street. “We are in a watershed moment,” she says. “The smartest cities are not going to be the ones that have the smartest technologies, but the ones where you don’t need a car.”

‘WE ARE IN A WATERSHED MOMENT. THE SMARTEST CITIES ARE NOT GOING TO BE THE ONES THAT HAVE THE SMARTEST TECHNOLOGIES, BUT THE ONES WHERE YOU DON’T NEED A CAR’



Since removing traffic from its city centre, Oslo’s streets are home to play areas and outdoor concerts









5

SINGAPORE

GREEN CITIES & VERTICAL GARDENS

**Besides the city-state’s** famed gardens, Singapore’s thousands of high-rise buildings are adorned with vegetation, normally in the form of vertical gardens, verdant walls and green roofs. There are even the giant artificial Supertrees – metal structures in Supertree Grove that are covered in green foliage.

Other than the aesthetic value, a layer of plants serves as a cooling agent, reducing the amount of heat that penetrates a building by up to 70 per cent. This combats the urban heat island effect whereby heat is trapped in built-up areas, and therefore minimises the use of air conditioning. Green spaces also mitigate the effects of pollution by filtering the air, and they play an important role in the wellbeing of residents.

“It’s only recently that the research has been lifted to a level where it is receiving attention from decision makers, and that cities are adopting nature-based solutions,” says Cecil Konijnendijk, a professor of urban forestry who is

based at the University of British Columbia. These green strategies must be balanced with the needs of growing populations, and so officials are being more creative in incorporating urban greenery. “Instead of just parks and trees, we’re going to have to integrate greenery into our architecture,” Konijnendijk explains.

Cue the vertical garden, an increasingly popular response to the scarcity of horizontal space. Outside of Singapore, vertical gardens cover walls in Copenhagen and São Paulo, while Paris is unveiling green corridors, known as “street canyons”.

Milan has pioneered the vertical forest on high-rise buildings, comprising a selection of plants, shrubs and trees picked

to adapt to the weather conditions of the site. Bosco Verticale, a pair of residential towers, absorbs 30 tonnes of CO<sub>2</sub> per year. Similar constructions will be rolled out in Liuzhou and Nanjing, China; Lausanne, Switzerland; Eindhoven, The Netherlands; Cancun, Mexico; and Cairo, Egypt, designed by Milan-based architecture studio Stefano Boeri Architetti. “The massive planting of trees is one of the most effective and economical ways to fight global warming, so we strongly believe in the establishment of vertical forests,” Stefano Boeri, the studio’s founder, says. “We must stop constraining nature and confining it to the outskirts of the city, and start considering it as an ally and as a partner.”

‘IT’S ONLY RECENTLY THAT RESEARCH HAS BEEN LIFTED TO A LEVEL WHERE IT IS RECEIVING ATTENTION FROM DECISION MAKERS, AND CITIES ARE ADOPTING NATURE-BASED SOLUTIONS’

What if you could design a building that uses no energy – or, better still, produces a surplus? Powerhouse Brattørkaia, an office block in Trondheim, Norway, is one of the world’s largest energy-positive buildings, at 17,800m<sup>2</sup>. It has 2,867m<sup>2</sup> of solar panels across its roof that produce around 500,000 kWh of clean energy in a year – twice the power the building actually uses. Excess energy is pumped back into the local grid.

Many building projects claim to be “net zero” or even energy-positive, but Powerhouse also accounts for the energy used to construct and recycle the building as well as day-to-day operations. Within 60 years, it will generate more than enough energy to cover this. “Once you start accounting for the energy used in all of the building materials and their CO<sub>2</sub> equivalents, you have a totally different calculation,” Kjetil Trædal Thorsen, co-founder of Snøhetta, the Oslo-based architecture and design firm behind Powerhouse, says.

Brattørkaia is the largest of four Powerhouse projects in Norway, but Trædal Thorsen hopes to export his designs to other cities. The upfront costs are similar to a traditional building, but operational and maintenance costs are far lower.

Not every building can become energy positive, so Trædal Thorsen believes “a larger, community-based zero emissions strategy,” should be embraced. He points to energy-positive neighbourhoods where over-production of energy by some buildings compensates for energy-sapping ones, creating a decentralised, zero net emissions energy network.

Buildings account for 40 per cent of energy use and 36 per cent of CO<sub>2</sub> emissions in the EU. “If you can achieve this in our climate, you can achieve it anywhere,” says Peter Bernhard, senior consultant at Asplan Viak, which was involved in the project. “Cities can be part of the energy solution.”

Powerhouse Brattørkaia makes enough energy to share with its neighbours



ILLUSTRATION: (LEFT PAGE) LEONIE BOS



Kampung Admiralty is a vertical retirement village with huge built-in green walls and terraced gardens



Trellis Towers at Ang Mo Kio is a 30-storey block using climbing plants over its exterior for shade



## RECYCLED ROADS

**Imagine driving on a perfectly flat road** that has no potholes – and which can be recycled when you’re done with it. Such a road is coming to Los Angeles after Mayor Eric Garcetti decided to work with road tech company TechniSoil Industrial on replacing the city’s bus lanes and deteriorating asphalt.

TechniSoil uses plastic waste, otherwise destined for landfill or our oceans, as a replacement for bitumen – the black, oil-derived sludge that holds traditional roads together. The new surface makes use of all the asphalt that has already been laid, meaning that the roads are in effect recycled rather than replaced. This saves the tremendous carbon resources required to bring in new and take away old asphalt each time. TechniSoil claims its roads are eight to 13 times more durable in lab tests, and it anticipates a lifecycle double that of a regular road.

TechniSoil uses approximately 2,300kg of recycled PET plastic per 1.5km of two-way road, which equates to around 395,000 plastic bottles, but CEO Sean Weaver hopes to double this content by 2022. “We’re turning something meaningless into the single most valuable piece of infrastructure,” he says. “We can consume all of the world’s waste plastic into our system within the next eight years. There is no other technology that can do that.”

The idea of adding waste plastic into roads dates back to 2001 when Rajagopalan Vasudevan, an Indian chemistry professor, recognised plastic’s binding qualities and pioneered a plastic-bitumen road-laying technique across India. With newer technologies, plastic roads can meet higher road standards, and the idea is spreading globally.

Shell and Total have enhanced roads with newly-produced polymers, but several companies are seeking to use waste plastics for the same purpose. Besides TechniSoil, there’s Dow Chemical, which has worked with local governments across Indonesia, India and Thailand since 2017; and Scottish company MacRebur, which makes road products that replace part of the bitumen with waste plastic

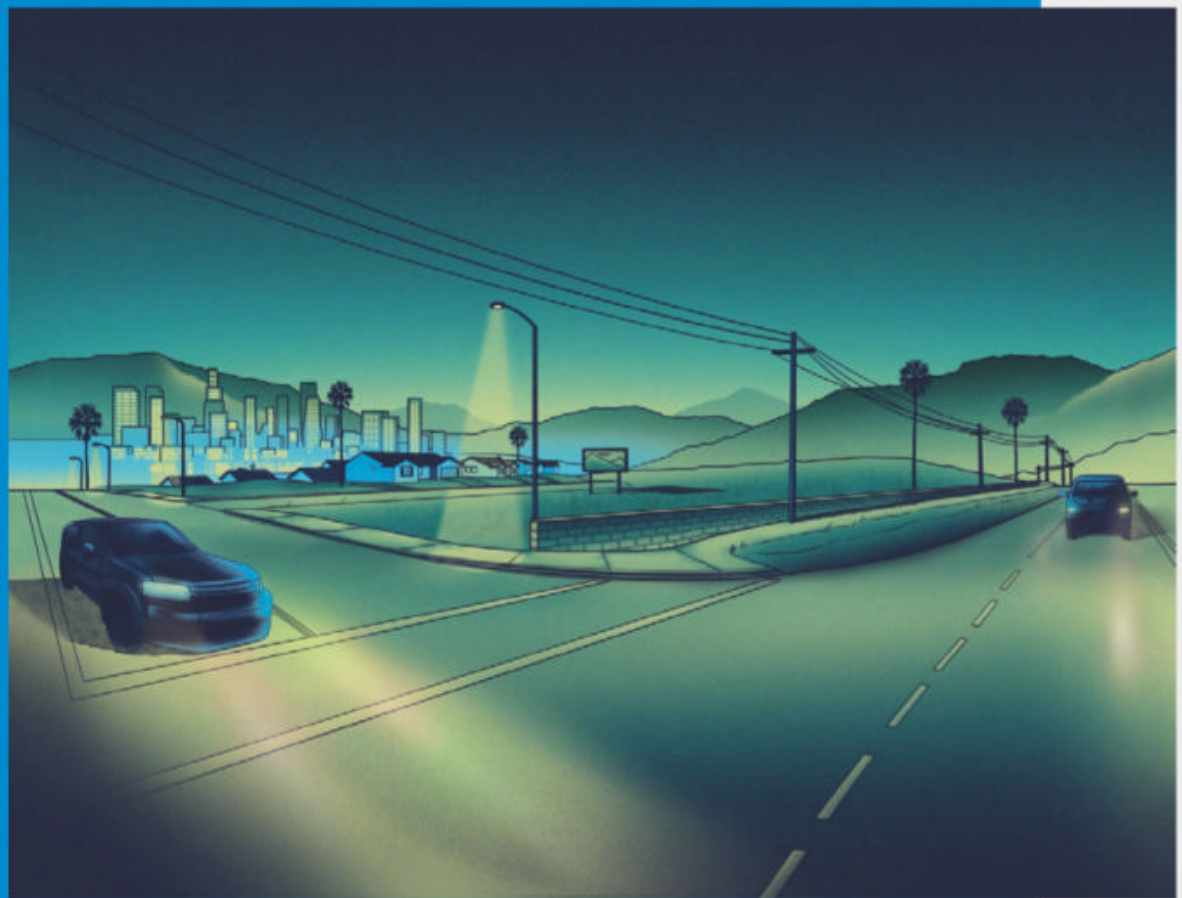
crumbs. Dutch company PlasticRoad makes roads entirely of waste plastic, which will now be taken to market after successful pilots in the cities of Zwolle and Giethoorn.

One concern is whether these roads shed microplastics. MacRebur and TechniSoil dismiss this on the basis that they’re turning the plastic into its original oil-based state, but environmentalists encourage caution. “Even if the roads are more resilient, you would assume that, especially if they are

made completely from waste plastic, they would eventually erode to some extent and that would contribute to a problem they’re supposed to be solving,” Libby Peake, head of resource policy at Green Alliance, says.

LA’s commitment could still be a watershed. “The roads of the future are going to be perpetual roads,” Weaver says. “If the city or the state gets better value for their dollar, and the user gets better value for their tax dollar, then you’re not going to be able to stop it.”

Road surfaces could help solve the problem of plastic waste by incorporating it into a substitute for bitumen



**‘WE’RE TURNING SOMETHING MEANINGLESS INTO THE SINGLE MOST VALUABLE PIECE OF INFRASTRUCTURE. WE CAN CONSUME ALL OF THE WORLD’S WASTE PLASTIC INTO OUR SYSTEM’**

**TechniSoil claims its process uses 2,300kg of waste plastic per 1.5km of two-way road**







Outside of China, Santiago in Chile currently has the largest number of electric buses in operation



To accommodate its e-buses, Shenzhen Bus Group has built 106 charging stations with 895 charging terminals



8

SHENZHEN, CHINA

## ALL-ELECTRIC PUBLIC TRANSPORT

**Shenzhen, China is the** world’s first city to realise the full electrification of its bus fleet. Besides the fact that they’re quieter, the city’s 16,000 electric buses emit around 48 per cent less carbon dioxide and much fewer pollutants than diesel buses. They’re also cheaper to fuel and easier to maintain. (Shenzhen Bus Group, the largest of the three bus companies in the city, estimates that an electric bus costs approximately \$98,000 annually, compared to \$112,000 for a diesel bus.)

As they seek to curb carbon emissions, global municipal leaders are pledging to replace all or part of their city’s fleets with e-buses. But there are hurdles to this goal: upfront costs can vary depending on location, but tend to be approximately two to four times that of a diesel bus.

Pilot phases have also exposed some e-bus shortcomings. The vehicles struggled on the rough roads in Bogota, Colombia, and on the steep hills of Cape Town. Albuquerque, New Mexico cancelled orders after discovering equipment problems during testing, and battery performance can be adversely impacted by extremes of temperature.

Then there’s the problem of infrastructure. E-buses need to be recharged approximately every 200km, and chargers are expensive. They also use up a lot of space and are very power-hungry. Shenzhen’s fleet uses approximately 4,000 megawatt-hours, which is a lot when you consider that 1 MWh will power about 300 homes for an hour. “Buying the buses is one

thing, but electrification requires you to change your whole business model and network,” says Joseph Ma, deputy general manager at Shenzhen Bus Group.

Accommodating its 6,000 e-buses required the company to build 106 charging stations with a total of 895 charging terminals. Each terminal costs £57,000. Seventy-four stations were installed in depots already owned by the company, but they also had to procure 32 new sites, lay kilometres of power cable, and redesign the routes so that the e-buses stay near charging stations.

Nonetheless, city e-bus numbers are rising, particularly across South America. Santiago, Chile has the largest fleet outside China; California and New York are moving towards an all-electric public bus fleet by 2040; and the number of

e-bus registrations across western Europe tripled in 2019. Pune became the first Indian city to adopt e-buses in 2019, spearheading a national transformation.

Without greater central government support, countries will struggle to realise full electrification. Several programmes have been set up to help cities overcome the upfront capital cost of e-buses, and the prices are expected to become more affordable with higher order volumes. “We’re looking at a world where almost all of our buses will eventually be electrified,” Ryan Sclar, a research associate for the World Resources Institute’s global electric mobility team, says. “Even beyond environmental concerns, it makes long-term financial sense.” ■ *William Ralston is based between London and Berlin*

**Shenzhen’s fleet of electric buses emits 48 per cent less carbon dioxide than the diesel vehicles they replaced**



# Colophon



## HOW TO GET AHEAD IN SECURITY

Catherine Hyland got as up close and personal as one can to a world-famous whistleblower in exile, when she photographed this model of Edward Snowden’s head, which stops your digital home assistant from spying on you. “The world seems to be getting smaller and smaller through technology and our incessant need to stay constantly connected, so maybe we need something tangible and literal (however deadpan) to help make us more aware of how much of our personal data we give away so freely. I think that’s why I found it quite a soothing thing to photograph – it became about telling a story through the aesthetics, and it was nice to have a physical object I could hold on to, that summarises this idea that does make us all feel uneasy if we really think about what is happening in our homes.”

## RAISING A TOAST TO SENSIBLE TRUST ISSUES...

We have to call in some pricey stuff to photograph for our TIME watch guide and Desired product special – but they generally come with security guards, rather than warnings. In the case of the Rémy Martin Louis XIII cognac, they sensibly don’t trust photographers to not try a snifter of their £2,600-a-bottle beverage, and send out a dummy decanter that’s filled instead with mystery lookalike liquid. Bottoms definitely not up...



PUBLISHED BY CONDÉ NAST	PUBLISHED UNDER JOINT VENTURE
<b>Chief Executive Officer</b> Roger Lynch <b>Chief Operating Officer &amp; President, International</b> Wolfgang Blau <b>Global Chief Revenue Officer &amp; President, U.S. Revenue</b> Pamela Drucker Mann <b>U.S. Artistic Director and Global Content Advisor</b> Anna Wintour <b>Chief Financial Officer</b> Mike Goss <b>Chief Marketing Officer</b> Deirdre Findlay <b>Chief People Officer</b> Stan Duncan <b>Chief Communications Officer</b> Danielle Carrig <b>Chief of Staff</b> Samantha Morgan <b>Chief Data Officer</b> Karthic Bala <b>Chief Client Officer</b> Jamie Jouning	<b>Brazil:</b> Casa Vogue, Glamour, GQ, Vogue  <b>Russia:</b> AD, Glamour, Glamour Style Book, GQ, GQ Style, Tatler, Vogue
<b>CONDÉ NAST ENTERTAINMENT</b> <b>President</b> Oren Katzeff <b>Executive Vice President – General Manager of Operations</b> Kathryn Friedrich	<b>PUBLISHED UNDER LICENSE OR COPYRIGHT CO-OPERATION</b> <b>Australia:</b> GQ, Vogue, Vogue Living  <b>Bulgaria:</b> Glamour  <b>China:</b> AD, Condé Nast Traveler, GQ, GQ Lab, GQ Style, Vogue, Vogue Film, Vogue Me, Vogue Business in China  <b>Czech Republic and Slovakia:</b> La Cucina Italiana, Vogue
<b>CHAIRMAN OF THE BOARD</b> Jonathan Newhouse	<b>Germany:</b> GQ Bar Berlin  <b>Greece:</b> Vogue
<b>WORLDWIDE EDITIONS</b> <b>France:</b> AD, AD Collector, Glamour, GQ, Vanity Fair, Vogue, Vogue Collections, Vogue Hommes	<b>Hong Kong:</b> Vogue  <b>Hungary:</b> Glamour  <b>Korea:</b> Allure, GQ, Vogue, WIRED
<b>Germany:</b> AD, Glamour, GQ, GQ Style, Vogue	<b>Malaysia:</b> Vogue Lounge Kuala Lumpur
<b>India:</b> AD, Condé Nast Traveller, GQ, Vogue	<b>Middle East:</b> AD, Condé Nast Traveller, GQ, Vogue, Vogue Café Riyadh, WIRED
<b>Italy:</b> AD, Condé Nast Traveller, Experience Is, GQ, La Cucina Italiana, L'Uomo Vogue, Vanity Fair, Vogue, WIRED	<b>Poland:</b> Glamour, Vogue
<b>Japan:</b> GQ, Rumor Me, Vogue, Vogue Girl, Vogue Wedding, WIRED	<b>Portugal:</b> GQ, Vogue, Vogue Café Porto
<b>Mexico and Latin America:</b> AD Mexico, Glamour Mexico, GQ Mexico and Latin America, Vogue Mexico and Latin America	<b>Romania:</b> Glamour
<b>Spain:</b> AD, Condé Nast College Spain, Condé Nast Traveler, Glamour, GQ, Vanity Fair, Vogue, Vogue Niños, Vogue Novias	<b>Russia:</b> Vogue Café Moscow
<b>Taiwan:</b> GQ, Vogue	<b>Scandinavia:</b> Vogue
<b>United Kingdom:</b> London: HQ, Condé Nast College of Fashion and Design, Vogue Business; <b>Britain:</b> Condé Nast Johansens, Condé Nast Traveller, Glamour, GQ, GQ Style, House & Garden, LOVE, Tatler, The World of Interiors, Vanity Fair, Vogue, WIRED	<b>Serbia:</b> La Cucina Italiana
<b>United States:</b> Allure, Architectural Digest, Ars Technica, basically, Bon Appétit, Clever, Condé Nast Traveler, epicurious, Glamour, GQ, GQ Style, healthyish, HIVE, La Cucina Italiana, Pitchfork, Self, Teen Vogue, them., The New Yorker, The Scene, Vanity Fair, Vogue, WIRED	<b>Singapore:</b> Vogue
	<b>South Africa:</b> Glamour, GQ, GQ Style, House & Garden
	<b>Thailand:</b> GQ, Vogue
	<b>The Netherlands:</b> Glamour, Vogue, Vogue Living, Vogue Man, Vogue The Book
	<b>Turkey:</b> GQ, Vogue, Vogue Restaurant Istanbul
	<b>Ukraine:</b> Vogue, Vogue Café Kiev
	<b>Condé Nast is a global media company producing premium content with a footprint of more than 1 billion consumers in 32 markets. <a href="https://www.condenast.com">condenast.com</a></b>

Published by The Condé Nast Publications Ltd, Vogue House, Hanover Square, London W1S 1JU [tel: 020 7499 9080; fax: 020 7493 1345]. Colour origination by williamslea. Printed in the UK by Walstead Roche. WIRED is distributed by Frontline, Midgate House, Peterborough, Cambridgeshire, PE1 1TN, United Kingdom [tel: 01733 555161]. Subscription rates include delivery and digital editions. Full rates are £29.94 for one year in the UK, £48 for the rest of the world. To place your order call 0844 848 5202 in the UK or +44 (0)1858 438 815. Landline calls to 0844 numbers will cost more than 5p a minute calls made from mobiles usually cost more. Special offers and exclusive promotions are published in this issue or online at [wired.co.uk](https://www.wired.co.uk). To manage your subscription log onto [www.magazineboutique.co.uk/solo](https://www.magazineboutique.co.uk/solo). For subscription enquiries email [wired@subscription.co.uk](mailto:wired@subscription.co.uk) or mail Condé Nast Britain, Subscriptions Department, Tower House, Sovereign Park, Market Harborough, LE16 9EF, UK. All rights reserved. Reproduction in whole or in part without written permission is strictly prohibited. WIRED cannot be responsible for unsolicited material. Copyright © 2018 THE CONDÉ NAST PUBLICATIONS LTD, Vogue House, Hanover Square, London W1S 1JU. The paper used for this publication is based on renewable wood fibre. The wood these fibres are derived from is sourced from sustainably managed forests and controlled sources. The producing mills are EMAS registered and operate according to highest environmental and health and safety standards. This magazine is fully recyclable - please log on to [www.recyclenow.com](https://www.recyclenow.com) for your local recycling options for paper and board. WIRED is a member of the Independent Press Standards Organisation [which regulates the UK's magazine and newspaper industry]. We abide by the Editors' Code of Practice [[www.ipso.co.uk/editors-code-of-practice](https://www.ipso.co.uk/editors-code-of-practice)] and are committed to upholding the highest standards of journalism. If you think that we have not met those standards and want to make a complaint please see our Editorial Complaints Policy on the Contact Us page of our website or contact us at [complaints@condenast.co.uk](mailto:complaints@condenast.co.uk) or by post to Complaints, Editorial Business Department, The Condé Nast Publications Ltd, Vogue House, Hanover Square, London W1S 1JU. If we are unable to resolve your complaint, or if you would like more information about IPSO or the Editors' Code, contact IPSO on 03001232220 or visit [www.ipso.co.uk](https://www.ipso.co.uk)

PHOTOGRAPHY: CATHERINE HYLAND



**WIRED Consulting**  
takes the WIRED  
knowledge, brand  
and network to  
businesses, enabling  
them to understand  
the trends that matter,  
navigate the path  
ahead and build  
a sustainable future

**We're in the business of  
anticipating change.**

**Are you?**

**[Consulting@wired.co.uk](mailto:Consulting@wired.co.uk)**

**WIRED**  
**Consulting.**



# THE WIRED MATRIX



## ROCK PAPER STORIES

Become the star of your very own Motorsport inspired comic. Pick up The Rookie and experience the power of classic storytelling with a unique customised twist. Shop online today! Visit [rockpaperstories.com](https://rockpaperstories.com)



## ARTICTURE

Articture is a premium home decor brand striking a balance between artistic freedom and functional excellence. Every item in their curated collection passes through a rigorous quality control process ensuring elite products that not only long to be seen, but are proven to be robust. Visit [articture.com](https://articture.com) and follow [@articture](https://www.instagram.com/articture) on IG.



## STRØM

STRØM is a Belgian fashion label that combines colourful, minimal designs with high-quality, sustainable fabrics. STRØM stands for unconditional friendship and the moments of happiness we share together. Visit [strom-clothing.com](https://strom-clothing.com)



## SPACE ACADEMY SUPPLY CO

Space Academy Supply Co. is a brand known for its attention to detail and unique style, incorporating bright colours and innovative patterns influenced by contemporary design and vintage style. The Galaxy Camo Single Layer Jacket is the perfect example of that style. Visit [spaceacademysupplyco.com](https://spaceacademysupplyco.com) IG [@spaceacademysupplyco](https://www.instagram.com/spaceacademysupplyco)

## BILLY RUFFIAN

In addition to their collection of handcrafted shoes, Billy Ruffian also offer a selection of accessories to personalise your look this season. With coloured laces and a large choice of patterned socks, there is a multitude of style combinations. Along with a stylish leather card case, all act perfectly as add-on presents. Visit [billyruffianshoes.co.uk](https://billyruffianshoes.co.uk) IG: [@billyruffianshoes](https://www.instagram.com/billyruffianshoes)



## MOONA

Based on sleep science, Moona is a pillow cooling system that can help to improve your sleep by targeting the head and neck area with the perfect temperature. Its unique technology continuously circulates thermoregulated water between the bedside POD and the pillow PAD in order to maintain your chosen temperature between 18°C and 35°C. Moona learns, night after night, and adapts its recommendations to your personal taste to help you get a better nights sleep. The accompanying mobile app enables you to manage your sleep profile, set up a “thermal alarm” clock, get insights about your sleep and much more. To find out more visit [en.getmoona.com](https://en.getmoona.com)

WIRED  
ADVERTISING  
FEATURE



## BLUBLOX

Combining Australian made blue light lenses with ultra fashionable frames, BLUblox deliver the most optimal science backed blue light filtering eyewear for our digital world, aiming to help alleviate digital eye strain. Available in non-prescription, prescription and readers and there's even a send-your-own-frame service. Featured is their Crystal BluLite glasses. Save 15% with code wired15 [expires 03/12/20]. Visit [blublox.com](https://blublox.com) IG: [@blubloxofficial](https://www.instagram.com/blubloxofficial)



## LEAN GREENS

Throw away your juicer! Lean Greens allows you to sneak more veggies into your day in 30 seconds or less. Go to [leangreens.com/wired](https://leangreens.com/wired) for their new customer bundle.



## EMPIRE CLOTHING

Founded in 2017 by Ajak (Peter) King, EMPIRE CLOTHING is a streetwear brand entrenched and based upon current and relevant culture, reflecting ‘the now’ that our society appreciates and values. With definitive opinions and unique visionaries from their many collaborators, seasonal men’s and women’s clothing are offered. Visit [empireclothing.store](https://empireclothing.store)



# 11/12.20

TO JOIN US ON THESE  
PAGES CONTACT :  
020 7499 9080 EXT 3705



## BUCQLE

Meet Bucqle, the modern replacement for the belt. Gaining and dropping weight can be a hassle when it comes to dressing up. Your belt might not always be the solution when maintaining your perfect fit. Bucqle is a unisex premium accessory to tighten the waistband of your pants and skirts by the millimetre to the perfect fit per person. It is basically the belt without the strap, but simplified and easier to use. Bye bye belt. Hello Bucqle! Visit [bucqle.com](https://bucqle.com)

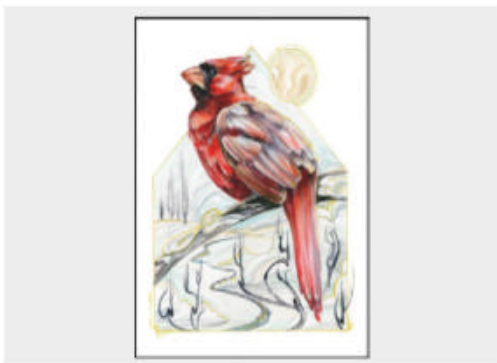


## MAKERS CABINET

Makers Cabinet creates beautiful analogue drawing tools that elevate the drawing experience to an art form. Machined from solid metals, Høvel, Iris and Stria showcase the most time-honoured materials and mechanisms. Use WIRED10 on [makerscabinet.com](https://makerscabinet.com) for 10% off (expires 03/12/20) and follow [@makerscabinet](https://www.instagram.com/makerscabinet) on IG.

## SOLUS+

Introducing a sleek, cost efficient and smart electric heater. It delivers a new standard of electric infrared heating backed by a powerful smart home app that helps users reduce energy consumption and live more sustainably. The companion app comes with a range of ever-growing controls and energy saving features, such as remote access, smart scheduling, real time cost monitoring, zonal heating and more. Koleda have designed a modern heater that isn't limited by the hardware it came with, but one that is always upgrading and improving for the users. Visit [koleda.co](https://koleda.co)



## SARA RICHARD

Featured here is a seasonal cardinal watercolor gliecee by Sara Richard available signed in her online store at [sarahrichard.com](https://sarahrichard.com). Follow her art on IG: [@SaraRichardArt](https://www.instagram.com/SaraRichardArt)



## THE PLANT ERA

The Plant Era is on a mission to deliver the world's best nutrition. They are committed to a relentless pursuit for better by innovating, developing, and challenging the status quo. Available in Dark Chocolate and Strawberry-Basil, the organic protein contains no added sugar, dairy, and artificial sweeteners. Shop today on [theplantera.com](https://theplantera.com)

## URBANISTA

Silence the outside world or let the sound in with Urbanista London, the Swedish lifestyle audio brand's latest true wireless earphones with Active Noise Cancelling and Ambient Sound Mode. Available in Midnight Black, Rose Gold, Dark Sapphire and White Pearl at [urbanista.com/london](https://urbanista.com/london) IG: [@urbanistalife](https://www.instagram.com/urbanistalife)



WIRED  
ADVERTISING  
FEATURE

## STEPHANIE DILLON

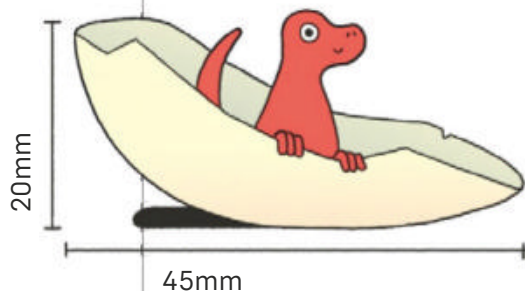
Stephanie Dillon is a multi-disciplinary artist based in Minnesota. Her vibrant works are made with found materials, acrylic paints and recycled canvases. She believes that old is still beautiful, what we have is enough, and art is everywhere. She also rescues shirts from landfills, places art on them and sells them. This shirt was created to inspire everyone to get out and vote. It was designed with painted art from Stephanie's collection then digitally enhanced by Tiani Hageman with the Revolution of Cassandra logo. Find more of her works at [stephaniedillonart.com](https://stephaniedillonart.com) and on IG: [@stephaniedillonart](https://www.instagram.com/stephaniedillonart). Zero carbon tees: [citizen-t.com](https://citizen-t.com) and [@citizentee](https://www.instagram.com/citizentee)





# £2.63 BILLION

Amount that digital downloads generated for the UK video game industry in 2019, almost 70 per cent of total revenues



# 45 X 20MM

The size of the smallest fossilised non-avian dinosaur egg, found in Tamba City, Hyogo, Japan

Percentage of gamers who'd rather their home be destroyed than lose their game-save data

# 10%

# 756,000

The number of fans who tuned in to K-Pop group BTS' live music concert stream, making it the world's most watched live stream of a music concert ever, as of June 2020

# 3,857,579

The number of commercial flights taking place across the world in June 2019, nine months before lockdown

# 1,904,765

Commercial flights taking place across the world in June 2020, one year later, during lockdown

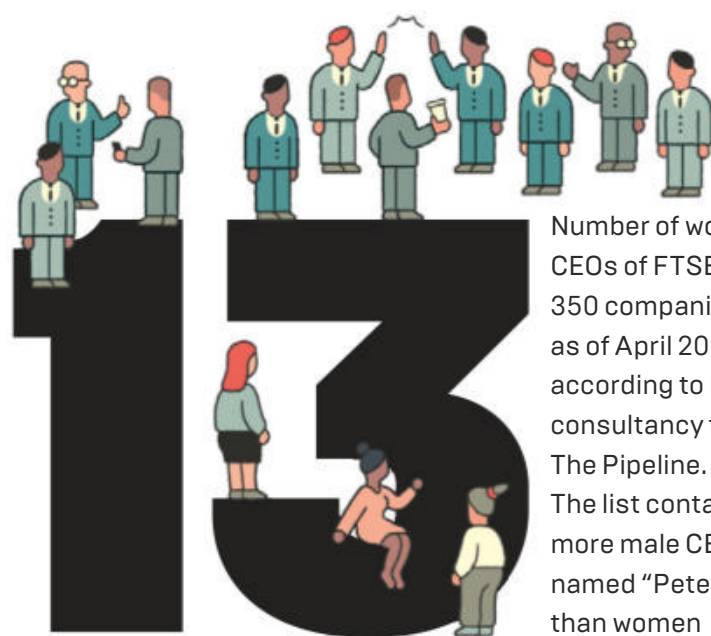


Percentage of people attending five or more virtual events per month since the global pandemic began, according to Eventbrite

# 62%

# 24,000 KILOMETRES PER SECOND

Or eight per cent the speed of light, is how quickly S4714, the fastest star in the Milky Way, is moving through space



Number of women CEOs of FTSE 350 companies as of April 2020, according to D&I consultancy firm The Pipeline. The list contains more male CEOs named "Peter" than women

# 54.4°C

The highest temperature ever recorded on Earth. It was hit in August 2020 in Death Valley National Park, California, during a heatwave on the US west coast

# 54°C

The previous highest recorded temperature on Earth, which was reached just seven years prior in 2013, and was also in Death Valley National Park, California

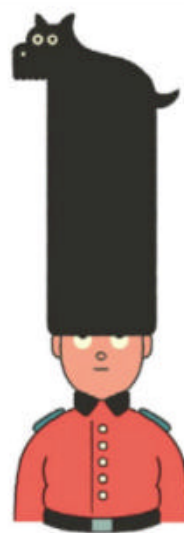


# £2,700

Average amount of money added to the overall household bill by adult "boomerang children", who moved back in with their parents during 10.5 weeks of the coronavirus crisis, according to a survey by Barclays bank

# 250M

Number of tweets expressing gratitude or thanks between March and May 2020, a 26 per cent increase since February

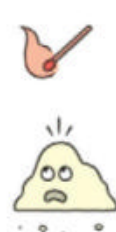


# 25%

The proportion of Brits who bought a puppy during lockdown who admit they did so on impulse according to The Kennel Club

# 2,750

Tonnes of ammonium nitrate which detonated in Beirut on August 4, 2020, killing 180 people and injuring over 6,000



# 800

Tonnes of ammonium nitrate which detonated in Tianjin, China in 2015, killing 173 people and injuring 798



**Good cars get you from A to B. Great cars get you in trouble.  
And the best cars in the world? They get you here...**

**The 2021**

# **CarGO Awards**

**There is no substitute.**

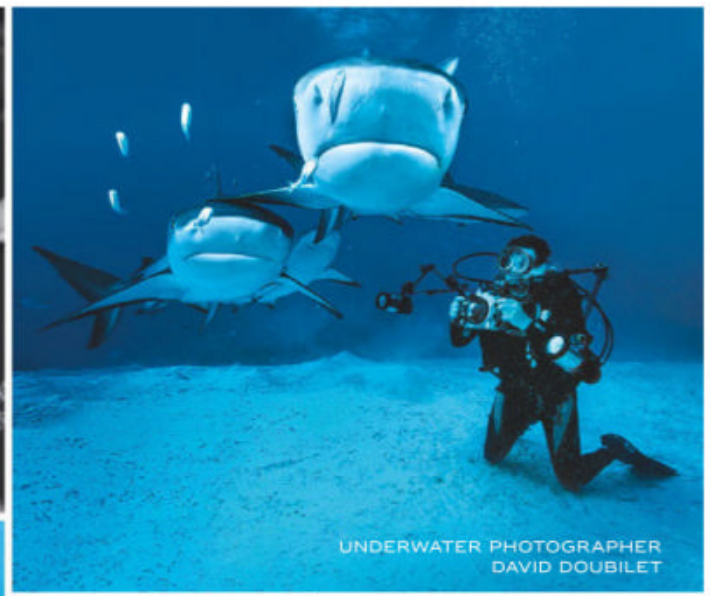
IN ASSOCIATION WITH







LEGENDARY MARINE BIOLOGIST  
SYLVIA EARLE



UNDERWATER PHOTOGRAPHER  
DAVID DOUBILET



EXPLORER  
GHISLAIN BARDOUT



ROLEX GLIDELock  
EXTENSION SYSTEM

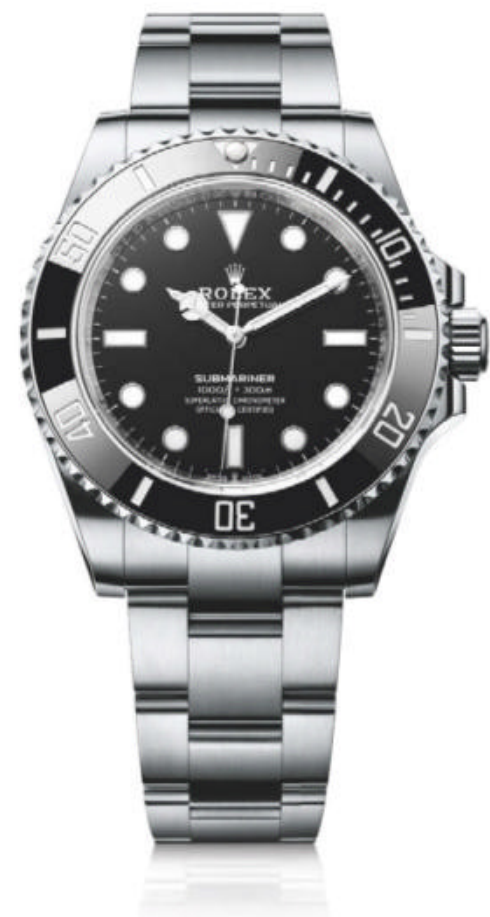


CALIBRE 3230

## THE NEW GENERATION SUBMARINER

Built for divers in 1953, the Submariner soon set the standard, making it the ultimate watch for underwater exploration. A symbol of waterproofness and reliability, the iconic design transcended its original purpose. While remaining true to its diving heritage, the Submariner also became the watch of choice on land, and the perfect companion to mark the memorable moments in the lives of its wearers. Now, with a new 41 mm case and a next generation movement, the story of the Submariner continues.

*#Perpetual*



OYSTER PERPETUAL SUBMARINER

  
**ROLEX**



Please turn the page to view Supplement







WIRED TIME

# Time

A magazine with  
WIRED November /

December 2020

for



change





REGISTER TO EXTEND YOUR  
INTERNATIONAL LIMITED  
WARRANTY FROM 2 TO 8 YEARS  
REGISTER ON [IWC.COM/MYIWC](http://IWC.COM/MYIWC)

**Portugieser Chronograph. Ref. 3716:** Sheets trimmed tight, your hands firmly on the wheel: the bow turns slowly through the wind, and the boat begins to pick up speed. For more than 80 years, the IWC Portugieser has been the watch of choice for ambitious individualists, who continuously look ahead and have clearly defined goals. Developed in the late 1930s and based on a hunter pocket watch movement, its clean, functional design took its inspiration from the deck watches used back then to calculate longitude. As a result, this timelessly modern watch combines the stylistic heritage of a pocket watch with the precision and readability of a nautical instrument. So, it's small wonder that lucky owners of this watch are only too ready to take on the elements and confidently set sail for new horizons. Fully aware that beyond each of those horizons, they can be sure of discovering their next goal.

**IWC. ENGINEERING DREAMS. SINCE 1868.**

LONDON BOUTIQUE · 138 NEW BOND STREET · W1S 2TJ · +44 (0) 203 618 3900 · [WWW.IWC.COM](http://WWW.IWC.COM)

For more information contact [info@iwc.com](mailto:info@iwc.com)



# WHAT IS AVAXHOME?



# AVAXHOME-

the biggest Internet portal,  
providing you various content:  
brand new books, trending movies,  
fresh magazines, hot games,  
recent software, latest music releases.

Unlimited satisfaction one low price

Cheap constant access to piping hot media

Protect your downloadings from Big brother

Safer, than torrent-trackers

18 years of seamless operation and our users' satisfaction

All languages

Brand new content

One site



# AVXLIVE • ICU

AvaxHome - Your End Place

We have everything for all of your needs. Just open <https://avxlive.icu>



**IWC PORTUGIESER.  
THE JOURNEY IS  
YOUR DESTINATION.**



**IWC**  
SCHAFFHAUSEN



Born on the race track,  
it's the spirit of endurance  
on your wrist.

---

FOREVER CHASING TOMORROW

---

**TAG HEUER CARRERA**  
Original Racing Chronograph

449 OXFORD STREET, LONDON







DON'T CRACK UNDER PRESSURE



TAGHEUER.COM









# TUDOR

## #BORN TODARE

What is it that drives someone to greatness? To take on the unknown, venture into the unseen and dare all? This is the spirit that gave birth to TUDOR. This is the spirit embodied by every TUDOR Watch. Some are born to follow. Others are born to dare.



### Snowflake hands

A hallmark of TUDOR divers' watches since 1969



### Manufacture calibre

MT5402 with 70-hour "weekend-proof" power-reserve, silicon hair-spring and COSC-certification



**39 millimetre case**  
in 316L stainless steel



**Five-year transferable guarantee** with no registration or periodic maintenance checks required

**BLACK BAY FIFTY-EIGHT**



**URWERK<sup>®</sup>**  
BY BAUMGARTNER + FREI

[WWW.URWERK.COM](http://WWW.URWERK.COM)



UR  
100

"I think the duration of an hour should be a period of play. It should be celebration for that one specific hour in life and so you should have something on your watch, something exciting, thrilling and engaging to represent it."

*F. Baumgartner*

**FELIX BAUMGARTNER**  
Co-founder of URWERK  
Master watchmaker

*M. Frei*

**MARTIN FREI**  
Co-founder of URWERK  
Artist and Chief designer



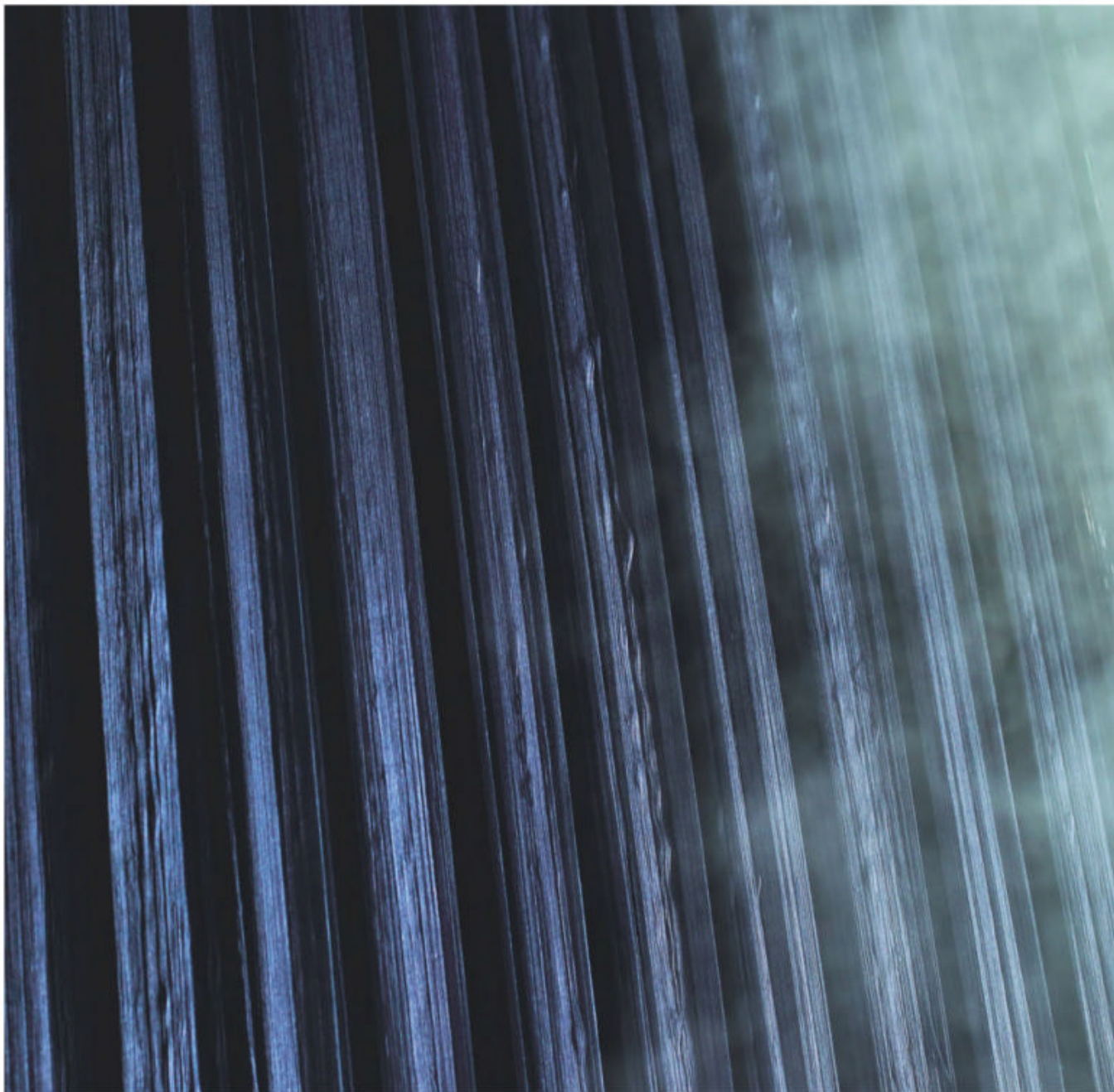
UR

THE UR-100

UR-100 in 2N Gold with orbital hour satellites

[WWW.URWERK.COM](http://WWW.URWERK.COM)





These stripes tell a story.  
Of a maverick. And a warrior.  
And of a meeting of minds.  
Introducing the Oris x Momotaro.

Made without compromise.  
Made for the urban battle.

**#GoYourOwnWay**



Oris x Momotaro



**ORIS**  
HÖLSTEIN 1904

**ORIS BOUTIQUE LONDON**  
41 South Molton Street  
London  
W1K 5RP





Luxury during lockdown	10
Close up: Hamilton PSR	14
Retro	16
Expert: bracelets	20
Expert: smartwatches	21
Close up: Audemars Piguet	22
Tudor: the new process	24
Expert: diver	32
Expert: all-rounders	33
Blockchain reaction	34
Fetish: lume	38
Instant approval	42
Inner works: Piaget	45
Timely releases	46
Editor	Greg Williams
Supplement editor	Jeremy White
Group creative director	Andrew Diprose
Managing editor	Mike Dent
Art director	Mary Lees
Acting director of photography	Kate Barrett
Contributors	Alex Doak, Marc Aspinall, Tim Barber, Leon Chew, Sam Chick, James Day, Cathal Duane, Chris Hall, Jason Heaton, Fien Jorissen, Tracey Llewellyn, Laura McCreddie-Doak, Felix Scholz
Publishing director	Nick Sargent
Group head of revenue and brand partnerships	Rachel Reidy
Associate director	Silvia Weindling
Senior partnerships director	Sam O'Shaughnessy
Associate director, partnerships	Jessica Holden
Partnerships executive	Amelia Morley
Partnerships art director	Jeffrey Lee
Partnerships designer	Duarte Soares
Senior project manager	Fiona Hill
Senior project manager	Amma Greenstreet
Project manager	Sian Bourke
Business manager	Jake Pummintr
Production director	Sarah Jenson
Commercial production manager	Xenia Dilnot
Acting production controller	Skye Meelboom
Senior production co-ordinator	Katie McGuinness
Commercial and paper production controller	Martin MacMillan
Advertising enquiries	020 7499 9080
Supplement free with WIRED	11.20



**Above: PATEK PHILIPPE CALATRAVA 5227R-001**  
Patek's flagship Calatrava was first launched in 1932, and though this 18ct rose gold edition is from 2013, its timeless looks mean it's still offered in the current range. An ivory lacquered dial features a date display at 3 o'clock, while beneath, the self-winding calibre 324 delivers 45 hours of power. £26,910 [patek.com](http://patek.com) (For more retro watches, see p16)

**On the cover:** a Tudor Manufacture Calibre MT 5402 sits on its custom assembly mount at the Tudor workshop in Geneva, Switzerland. (See page 24 for the full story)

Published by The Condé Nast Publications Ltd, Vogue House, Hanover Square, London W1S 1JU (tel: 020 7499 9080; fax: 020 7493 1345). Colour origination by williamslea. Printed in the UK by Walstead Roche. WIRED is distributed by Frontline, Midgate House, Peterborough, Cambridgeshire, PE1 1TN, United Kingdom (tel: 01733 555161). Subscription rates include delivery and digital editions. Full rates are £29.94 for one year in the UK, £48 for the rest of the world. To place your order call 0844 848 5202 in the UK or +44 (0)1858 438 815. Landline calls to 0844 numbers will cost more than 5p a minute calls made from mobiles usually cost more. Special offers and exclusive promotions are published in this issue or online at [wired.co.uk](http://wired.co.uk). To manage your subscription log onto [www.magazineboutique.co.uk/solo](http://www.magazineboutique.co.uk/solo). For subscription enquiries email [wired@subscription.co.uk](mailto:wired@subscription.co.uk) or mail Condé Nast Britain, Subscriptions Department, Tower House, Sovereign Park, Market Harborough, LE16 9EF, UK. All rights reserved. Reproduction in whole or in part without written permission is strictly prohibited. WIRED cannot be responsible for unsolicited material. Copyright © 2018 THE CONDÉ NAST PUBLICATIONS LTD, Vogue House, Hanover Square, London W1S 1JU. The paper used for this publication is based on renewable wood fibre. The wood these fibres are derived from is sourced from sustainably managed forests and controlled sources. The producing mills are EMAS registered and operate according to highest environmental and health and safety standards. This magazine is fully recyclable - please log on to [www.recyclenow.com](http://www.recyclenow.com) for your local recycling options for paper and board. WIRED is a member of the Independent Press Standards Organisation (which regulates the UK's magazine and newspaper industry). We abide by the Editors' Code of Practice [[www.ipso.co.uk/editors-code-of-practice](http://www.ipso.co.uk/editors-code-of-practice)] and are committed to upholding the highest standards of journalism. If you think that we have not met those standards and want to make a complaint please see our Editorial Complaints Policy on the Contact Us page of our website or contact us at [complaints@condenast.co.uk](mailto:complaints@condenast.co.uk) or by post to Complaints, Editorial Business Department, The Condé Nast Publications Ltd, Vogue House, Hanover Square, London W1S 1JU. If we are unable to resolve your complaint, or if you would like more information about IPSO or the Editors' Code, contact IPSO on 0300 123 2220 or visit [www.ipso.co.uk](http://www.ipso.co.uk)





ILLUSTRATION: MARC ASPINALL

From virtual boutique experiences to digital launches, the watch industry has had to embrace e-commerce and go where its customers are – namely at home, locked down, but ready to shop



# Luxury's lockdown transformation

How the global crisis accelerated the move to digital – and why there's no going back. By Tracey Llewellyn

**As December 31, 2019 crossed into** January 1, 2020, few had much concern for the virus creeping through Asia.

However, as the weeks progressed and Covid-19 began to spread across the world, everything changed, including for the watch industry. Shows were cancelled, new launches were put on hold, and bricks-and-mortar retail ceased as countries locked down.

With watches that had been in development for many years, the notoriously staid watch industry had limited choices: get onboard with digital, or go into indefinite shutdown.

Watches were launched in hastily organised online "events" including Breitling's Summit Webcast and Geneva's Watches & Wonders show.

While some brands, led by Rolex, refused to sell online, others, including Patek Philippe, did allow retail partners to sell via e-commerce channels. (Amazingly, these brands had no capability in this area, despite global e-commerce now being a \$4tn industry.)

For Richemont – the group behind Cartier, IWC, Panerai and a dozen-plus other watch brands – online selling was already familiar territory, both in terms of the brand's own e-shops and marketplaces, Mr Porter and Watchfinder. For others, however, the race was on to find alternative ways to deliver.

According to Bulgari's CEO Jean-Christophe Babin, the Covid crisis has had a dual effect, with short-term plans speeding up and mid- to long-term plans slowing down. "Shops closed worldwide, compelling us to rethink our sales approach," he says. "We already had e-commerce platforms in Japan, China and the US, but the crisis drove Bulgari to extend these operations to a wide number of markets. Globally, Covid-19 has contributed to modifying the mindset of luxury brands that were not keen on using e-commerce so intensively."

Managing director of Bulgari's watch division, Antoine Pin, confirms that lockdown generated an acceleration in e-commerce watch sales of between 100 and 300 per cent depending on the market, a pace that is continuing as the world starts to open up. But despite strong digital sales, Babin does not believe that online will ever replace the bricks-and-mortar experience for top-end products, and emphasises that physical stores will remain the main channel for Bulgari. "Digital shopping is culturally established in Asia and the US," he admits, "but you reach a limit when it relates to luxury products offered by a brand such as Bulgari, which proposes a client experience through direct contact in-store."

For Zenith's CEO Julien Tornare, the pandemic was an opportunity for the watch world to demonstrate how adaptable it can be. Already committed to a move into e-commerce, including the brand's digital On Air forum that has given consumers direct access to brand executives and partners, he believes that innovation and flexibility in reworking the company strategy came to the fore during lockdown. For Tornare, the crisis accelerated the brand's plans by at least a year.

"Just a year ago, who would have thought we would be receiving orders via Instagram?" he says. "But if you want to be a dynamic, innovative brand, e-commerce is so important. The Swiss watch industry tends to be

'Covid-19 has modified the mindset of luxury brands that were not keen on using e-commerce'





very conservative, but even the most conservative had to move on.”

However, the signs of a willing consumer appetite for digital purchases of luxury watches were there for all to see some years ago. In 2017, Omega’s first Speedmaster #SpeedyTuesday limited edition of 2,012 pieces sold out in less than five hours. When the second #SpeedyTuesday watch, the Ultraman, went on sale online in July 2018, it sold out all 2,012 units in less than two hours. At the end of April, Omega announced it was to extend its e-commerce platform across Europe, having previously only sold watches online in the US and UK.

Hublot, another LVMH brand finally joining the e-commerce revolution, admits to fast-tracking its online strategy due to the enforced closure of approximately 90 per cent of its retail network. Launched in June to coincide with the new Big Bang e connected watch, more and more watches have been added to the e-shop on the Hublot website with CEO Ricardo Guadalupe saying earlier this year that the real test of online success will come when traditional retail outlets reopen.

Identifying that, at the start of the crisis, only five per cent of the hard-luxury market had direct e-commerce channels, Patrick Pruniaux, CEO of Kering-owned Ulysse Nardin and Girard-Perregaux committed early to digital selling, saying: “As sales in brick-and-mortar could not happen, launching online stores was crucial.”

“The problems we’re facing are the same problems of almost all luxury businesses in the world today. It’s too early to know what the end result of the pandemic will be for the industry, but one key lesson is coming into sharp relief: no brand should neglect their customers closer to home or their e-commerce platforms.”

For David Edwards, managing director at Seiko UK Limited, offering e-commerce to clients was already a priority, with lockdown providing the perfect catalyst to begin trading Grand Seiko online for the first time in Britain, alongside wider Seiko collections. According to Edwards, “we focused on improved availability and brand information, and we ensured that we maintained ‘boutique level’ personal communications with our clients.”

Promoting Seiko’s boutique manager to digital marketing manager brought continuity of knowledge to online and the results are clear: between April 1

and June 30, more online sales were generated than in the previous 12 months combined. For Edwards, the challenge is “establishing consistency between our boutiques, wholesale partners and digital platforms to ensure our clients can experience Grand Seiko and Seiko in whatever way best suits.”

And, therein seems to lie the immediate future of British watch retail. While many physical outlets, from Patek Philippe’s Bond Street Salon to Breitling’s luxurious new Regent Street Townhouse, have reported lower footfall than in previous years, they have also suggested higher sales conversions.

And, while there is optimism that bricks-and-mortar retail will pick up in the coming months, the financial, technical and personnel investment that has been made in digital sales and marketing, plus new consumer expectations, means that when it comes to e-commerce, the watch industry as a whole is past the point of no return.

ILLUSTRATION: MARC ASPINALL

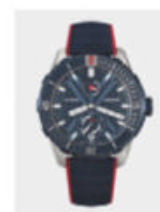
**Grand Seiko SBGJ235**  
**Heritage Collection**  
Case: steel, 40mm  
Strap: steel bracelet  
Calibre: 9S86 automatic  
£5,435 [grand-seiko.com](http://grand-seiko.com)



**Omega Speedy Tuesday (2017)**  
Case: steel, 42mm  
Strap: NATO/leather  
£poa (secondary)  
[omegawatches.com](http://omegawatches.com)



**Ulysse Nardin Diver X / Nemo Point**  
Case: titanium, 44mm  
Strap: blue fabric  
\$8,900 (edition of 300)  
[ulysses-nardin.com](http://ulysses-nardin.com)





# Built to meet the challenge of the oceans' depths

In 1983, a Seiko 600m diver's watch was attached to the research submersible Shinkai 2000 to test its durability. It exceeded expectations withstanding water pressure at a remarkable depth of 1,062m. Today's Prospex diver's watches are also built to challenge the oceans' depths. Experience counts.

## Keep Going Forward

# PROSPEX



©JAMSTEC \*Not guaranteed for all watches.

# SEIKO

SINCE 1881



# Digital retox

Hamilton's 'Time Computer' is back – and happily, it hasn't made too much progress. By Alex Doak



**"From time to time we show new products, but this is wild."** So said a grainy, black-and-white Johnny Carson on NBC's *Tonight Show* on May 5, 1970, beamed across the US on the eve of Hamilton Watch Company's biggest ever launch back in 1970: the world's first digital electronic wristwatch. "It will sell, I'm told, for \$1,500," said Carson to his millions of viewers. "So this watch can tell you the exact moment you went bankrupt."

In fact, the "Pulsar Time Computer" that came to market two years later cost even more than that – a cool \$2,100 in gold, exclusively from Tiffany's, which amounts to over \$13,000 adjusting for inflation. Even taking into account the bulk of precious metal, the net cost for what it

contained – technology less sophisticated than in LCD toys a decade later – still seems keen to say the least.

But Hamilton's price setters were justified – the watchmaker of Lancaster, Pennsylvania gave Johnny Carson the scoop on what was the Apple Watch of its day. It switched up quartz technology, pioneered for wristwatches by Seiko only a year earlier, with a cutting-edge combination of miniaturised logic board and red light-emitting-diode (LED) display that was activated at the push of a button (it sapped too much power to be permanently viewable).

In 1973, the Pulsar P2 came out in steel, lending even more groove to Hamilton's funkadelic space-age design, and – crucially – dropping the price tag to a more accessible (but still not-insignificant) \$275, or \$1,700 in today's money. Jack Nicholson snapped one up, as did Elton John and Keith Richards. It was a fleeting glimpse, but even James Bond couldn't resist swapping his standard-issue Rolex for a Pulsar at the start of *Live and Let Die* (trust Roger Moore to style it out in a decidedly non-futuristic monogrammed bath robe).

Half a century on from Hamilton's showstopping

reveal, the brand – now based in Switzerland as part of the Swatch Group – has listened to fans and delivered a like-for-like reissue of the funky P2 in both PVD-coated yellow gold (€945, limited to 1,970 pieces) and steel (€695).

It retains the push-to-view system on a display that's now a hybrid of OLED and LCD, meaning the time is at least permanently visible in daylight conditions. As with the original watch, a magnet embedded in the button closes a "reed switch" inside when brought into proximity to activate it.

With the new version, you no longer set the watch using a magnetic bar hidden in the clasp, and the watch is renamed the PSR, since Hamilton no longer retains the "Pulsar" trademark. Nonetheless, 50 years later, Johnny Carson is still correct: the Hamilton PSR is wild.

**Hamilton PSR Gold PVD Limited Edition**  
€945 [hamiltonwatch.com](http://hamiltonwatch.com)



# COUNT ON ME



CERTINA AND THE **DOUBLE SECURITY** CONCEPT  
NEVER LET YOU DOWN. [CERTINA.COM](https://www.certina.com)

**DS PH200M** · AUTOMATIC MOVEMENT ·  
ANTI-MAGNETIC NIVACHRON™ TECHNOLOGY · SWISS MADE

**CERTINA**  
SWISS WATCHES SINCE 1888





# Past times

**Anyone with a passing interest** in classic cars will have noticed an emergent trend in recent years, in which long-discontinued favourites are raised up, Lazarus-like, from the dead, and put back into production.

A few million pounds will net you a brand new Aston Martin DB4 GT Zagato, last made in 1963, a freshly minted 1957 Jaguar XKS, or even a supercharged 4.5-litre Bentley “Blower”, 12 of which are being made to match – down to the last engine rivet – the original quartet built for the racing driver Sir Tim Birkin in 1929.

A similar phenomenon has been occurring in the watch world, though the investment levels aren’t quite so eye-watering. Those demanding

## Modern watch brands are discovering bold new directions – by raiding their archives.

By Timothy Barber. Photography: Leon Chew

vintage kudos in a brand new watch can take their pick from examples as varied as Cartier’s revival of its lop-sided Art Deco beauty, the Tank Asymétrique; Grand Seiko’s rerun of its elegant debut wristwatch from 1960; and a black-on-white dial revival by Longines of a 1940s chronograph it’s calling the Tuxedo to name but a few. Even Timex has had success with a beguiling, hand-wound recreation of its urbane Marlin watch from the 1960s (complete with dinky 34mm sizing and domed Plexiglass crystal), yours for just £174.99.

Of course, the past has always cast a long shadow over an industry whose very existence today could be seen as anachronistic, and in which many of the most important historic designs have never really gone away. Patek Philippe’s flagship Calatrava, for instance, first saw light of day in 1932, and its Nautilus sports watch in 1974; meanwhile, almost the entirety of Rolex’s catalogue

descends unerringly from watches it created in the mid-20th century.

However, while the past remains fixed, the context for interpreting it has been in profound flux. A booming vintage market, and the proliferation of scholarship and awareness through online communities, has seen vintage watches once considered obscure or esoteric rising to desirability. Meanwhile, brands including Omega, Zenith and Audemars Piguet have spent millions on new museums that have opened in the past year, giving new showcases to their past. Conversely, factors including a surging smartwatch market and a fast-paced, increasingly fragmented digital landscape have only reinforced the nostalgic pulling power of a purely retro product.

“People want something of the ‘good old days’, something that’s an anchor in a difficult environment, politically and socially, and that was even before

### Longines Tuxedo

#### Laureato

Case: steel, 38.5mm

Strap: leather

Movement: automatic

£1,480 [longines.com](http://longines.com)



### Patek Calatrava

#### 5227G

Case: white gold, 39mm

Strap: alligator

Movement: caliber 324SC

£26,910 [patek.com](http://patek.com)







The Tag Heuer Carrera Montreal 160th Anniversary, an edition of 1,000 pieces, draws on the 1970s original with its flashes of yellow and red against a clean white dial. The strap is blue alligator. £5,550 [tagheuer.com](https://www.tagheuer.com)



the pandemic,” says Georges Kern, the CEO of Breitling, whose own Instagram feed is littered with pictures of vintage Breitling watches he’s come across.

Since taking up his post in 2017, Kern has refocused the brand by playing up the strength of its heritage, and launching recreations of key models such as the original 1957 Navitimer, and this year a military pilot’s watch from 1953, the AVI Ref. 765. Though made with modern methods and containing high-spec in-house movements, the watches are outwardly indistinguishable from the original editions.

TAG Heuer has taken a similar approach in hitting, albeit very gently, the reset button. Ahead of the launch this year of new collections in its Carrera line (which pulled this flagship marque in a more elegant direction after some overtly muscular styles in recent years), the brand brought out a note-perfect remake of the original Heuer Carrera from 1963.

“It’s a sort of parallel universe to the main collection,” says TAG Heuer’s creative director, Guy Bove. “You’re showing people where the Carrera and the brand itself comes from, and that gives a clear indication of where we can go in the future, too.”

All the watches mentioned here mix close adherence to historic designs with up-to-date interior technology, mostly with in-house movements greatly superior to the mechanisms that powered the earlier models.

However, for vintage connoisseurs, the engine of a classic watch can hold as much import, and convey as much

## ‘People want something of the “good old days”, something that’s an anchor in a difficult environment’

nostalgic enchantment as the design and history of the timepiece itself. That’s exemplified with Calibre 321, the chronograph movement that powered Omega’s original Speedmaster chronographs, including those worn by Nasa astronauts on the Moon. Omega retired the 321 from production in 1969, and today offers perhaps the most technologically advanced industrialised movement making in luxury watches.

That, however, has only served to increase the mythical significance of Calibre 321 among “Moonwatch” devotees. Last year, Omega did the hitherto unthinkable, revealing it had put the old movement back into production, and it was simply a job of digging out the original blueprints.

“It took us two years of research and development to bring the Calibre 321 back exactly as it was,” says Omega’s CEO Raynald Aeschlimann. “We needed every single component to be reproduced to its original specifications, which is a lot harder than you might think. We worked extensively with tomography X-ray technology on vintage pieces, with the original drawings and a process of reverse engineering of the original movement.”

This year’s steel Speedmaster containing the new/old Calibre 321 is utterly faithful to the mid-Sixties model – apart from a sapphire case-back to showcase the movement, which is hand-assembled in the old-fashioned way. It does, nevertheless, carry Omega’s modern five-year warranty.

“For many, the Moonwatch with a Calibre 321 is the true Speedmaster,” says Aeschlimann. “It relates to fans on a historical and technical level – and they have been demanding it for years. We knew it was something that deserved to be brought back.”

In contrast, Montblanc, which has a watchmaking history just two decades old, is managing to make watches with a pedigree dating back 162 years. How? In 2006, the fountain pen specialist acquired a historic watch-making operation then on the verge of collapse, by the name of Minerva, based in the Swiss village of Villeret.

The Omega Speedmaster 321 faithfully recreates the Calibre 321 movement from 1965. £12,050 [omega.com](http://omega.com)

### Breitling AVI Ref. 765

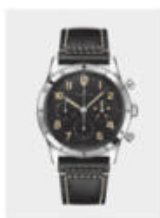
1953 re-edition

Case: stainless steel

Movement: caliber B09

Strap: leather

£6,590 [breitling.com](http://breitling.com)



### TAG Heuer Carrera

160th Anniversary

Case: steel, 39mm

Strap: leather

Movement: Heuer 02

£5,295 [tagheuer.com](http://tagheuer.com)





CHRONOMAT



  
**BREITLING**  
1884

#SQUADONAMISSION





# Guide



with January's launch of the eye-catching Streamliner Flyback Chronograph Automatic. Ostensibly a sports chronograph, the design of the watch began with the bracelet itself, according to CEO Edouard Meylan. "Moser is about functionality, ergonomics and minimalism," he says. "So the single-link bracelet, which is rather uncommon, became obvious to us. We then started building the case and then found the right movement." Like Hublot's, the bracelet and case are designed as an integrated whole, though Moser's version is almost menacingly smooth, somewhat

bracelet that contrasts polished C-shaped links against the brushed steel panels – though it may also be the quick-release system which enables swapping in rubber or calf-skin straps.

For Cartier, the bracelet never went out of fashion, as evidenced by the success of its sporty Santos line and its female equivalent, the Panthere. This year's Maillon de Cartier introduces an entirely new bracelet style inspired by the chunky links of a curb chain. Concept is one thing, but execution of the geometrically complex interlocking twists is quite another. Cartier reports a process of one year's research, multiple iterations and 35 prototypes to ensure the links were flexible enough and that, despite the angular design, the articulation was smooth and the finished piece easy to wear.

**Watch bracelets were, until** recently, somewhat ignored: while varied, interchangeable straps have flourished, the simple steel bracelet is seen as an item of hefty practicality rather than refinement.

However, the increasing popularity of luxury steel sports timepieces, led by a surging market for examples descended from the 70s heyday of prestige bracelet watches, has made them a focus for increasingly innovative design.

Earlier this year, Hublot introduced a new bracelet-bound version of its 15-year-old Big Bang. As with those 70s models, the central concept involves integrating the case

and bracelet seamlessly, rather than attaching a bracelet to a case designed for a strap – an objective that required subtly redesigning the case itself for the Big Bang Integral.

Breitling also made the bracelet a prime feature of its redesigned Chronomat chronograph, which reintroduced the prominent bullet-belt links of its "Rouleaux" bracelet, last seen in the late 80s. Breguet took the unusual step of placing a high-complication wristwatch – its chiming Marine Alarme Musicale – on a chunky new bracelet, while Montblanc also made retro seem modern with the "rice-grain" links on the bracelets for its 1858 range.

However, it was H. Moser & Cie, an independent maker of formal, minimalist haute horlogerie watches, which started the year off

reminiscent of H.R. Giger.

Czapek & Cie is another high-end independent bringing a new dimension to its watchmaking with an integrated bracelet model that harks back to 1970s forms. Known for crowdfunding its startup five years ago to the tune of 1.1 million Swiss Francs, the brand launched its £17,300 bracelet-bound Antarctique through an online subscription model during the pandemic lockdown, and business was reportedly swift. Perhaps buyers were charmed by an unusual

## CHAIN GANG



**Maillon de Cartier**

Case/bracelet: yellow gold  
Caliber: quartz  
£22,500 [cartier.co.uk](http://cartier.co.uk)



**H. Moser & Cie Streamliner Flyback Chronograph Auto**  
Case/bracelet: steel  
\$39,900 [h-moser.com](http://h-moser.com)

Above:

**Hublot Big Bang Integral**  
Case/bracelet: ceramic  
Caliber: Unico 2  
£19,100 [hublot.com](http://hublot.com)



**It has been five years since** the big Swiss watch brands first responded to the emergence of the now ubiquitous Apple Watch. What was once seen as a slightly anaemic, possibly begrudging offering from the traditionalists has been significantly improved since: TAG Heuer and Montblanc have released updated versions of their Connected and Summit watches, and Tissot has turned its long-standing T-Touch platform from curiosity into a genuine smartwatch. The latest to enter the fray is Hublot, with the launch of the Big Bang e. With other super-premium players including Louis Vuitton and Frederique Constant also well established in this sector, it is clear that, despite the Apple Watch outselling the entire Swiss watch industry in 2019, luxury watch brands are still unwilling to let the executives in Cupertino take their market without a fight. Hublot's foray into luxury smartwatches builds on its experiences with a limited edition piece it created for referees to wear at the 2018 Fifa World Cup.

This new watch, the Big Bang e, is a non-limited addition to the collection that has been produced in collaboration with its LVMH sister brands: that means it has a lot in common with TAG Heuer's Connected, save for the bespoke apps developed by TAG, and the chronograph-style pushers making their

Below:

**Hublot Big Bang e**

Case: black ceramic, 42mm

£4,800 [hublot.com](http://hublot.com)



**TAG Heuer Connected 2020**

Case: steel, 45mm

£1,495 [goldsmiths.co.uk](http://goldsmiths.co.uk)



debut on the newest iteration of the TAG Connected. (For 2020, TAG's 45mm smartwatch comes in steel or titanium flavours, and there's even a special edition specifically for golfers, featuring a white golf-ball-textured strap and an app that enables you to track your game across maps of thousands of golf courses.)

Seen in this context, Hublot's main achievement is incorporating the smartwatch hardware and complex, 42-piece case construction in a model that's no larger than a regular, mechanical Big Bang, with a diameter of 42mm.

One of the strengths of the Big Bang e is its inherent customisability; Hublot launched it with a conceptual dial design, created by French artist and Hublot "Art Ambassador" Marc Ferrero, that changes throughout the day – the promise is



**Tissot T-Touch Connect Solar**

Case: titanium, 45.5mm

£tbc [tissotwatches.com](http://tissotwatches.com)

that further artists and designers will submit their own interpretations on the smartwatch interface, and Big Bang e owners can freshen up their pieces according to whim or function.

The watch launches with the choice of titanium or black ceramic cases (both water-resistant to 30m) and the same quick-change strap functionality found on mechanical Big Bang watches. But, as with all things Hublot, expect a bevy of stylistic and material choices to emerge in the not too distant future.

2

## SMARTWATCHES



# Stay frosty

**Audemars Piguet brings a cool, tactile beauty to its high horology.** By Laura McCreddie-Doak

**Since teaming up with** Florentine jewellery designer Carolina Bucci in 2016, Audemars Piguet has left barely any surface unfrosted. Bucci's micro-hammering technique has been used to add shimmer to many of the brand's watches, and now brings perceptible handcraft to its most ground-breaking watch collection.

Audemars Piguet, founded in 1875, originally introduced its Concept range back in 2002. "This was the beginning of 21st century watchmaking as we know it today, before all the experimental indies like Greubel Forsey and Richard Mille came along," says Michael Friedman, head of complications at the watchmaker. "The Concept created a new pathway that said high horology can enter the field of experimentation and avant-garde design."

Through the collection, Audemars Piguet has explored materials with 2008's Royal Oak Concept Carbon, worked out how to time consecutive laps to impress Formula One world champion Michael Schumacher in 2015, and played with acoustics with 2016's chiming Supersonnerie.

In 2018, it produced its first Concept for women, the diamond-encrusted Royal Oak Concept Flying Tourbillon. This time around, Audemars Piguet has focused on surface texture with the Royal Oak Concept Frosted Gold Flying Tourbillon – what Friedman describes as a "celebration of the artistic, aesthetic nature



and beauty of the tourbillon over its technical attributes."

Here, the flying tourbillon is topped off by a disc of rotating precious stones that is surrounded by stepped blue rings edged with gold. The effect is akin to an optical illusion, as if looking down a well, or at ripples in a pond. The whole thing is enclosed in, of course, a frosted gold case.

"Frosted gold has been a lightning rod for us," says Friedman. "It showed us that even the most ancient of materials can still be re-imagined in new ways."

The watch also represents a particular intersection of the careers of two women – one a watchmaker, the other a jeweller. The highlighting of the tourbillon, with the eye led to it by the dial's architecture, recalls one of Audemars Piguet's most fêted modern-era wristwatches, the Tourbillon Automatique from 1986 – the world's first-ever self-winding tourbillon wristwatch, the first tourbillon with a titanium cage and, for a long time, the world's thinnest self-winding tourbillon.

That watch was designed by Jacqueline Dimier, head of design at Audemars Piguet until 1999, and redesigner of

# 2

the Royal Oak for women in 1976; the same watch Bucci was called upon to re-imagine for its 40th birthday.

**Audemars Piguet Royal Oak Concept Frosted Gold Flying Tourbillon CHF 145,000**  
[audemarspiguet.com](http://audemarspiguet.com)



DO WHAT  
YOU LOVE  
LONGER

SOLAR



**GARMIN**

[Garmin.com/solar](https://Garmin.com/solar)

QUATIX® 6X SOLAR



*Below:* a 3D-printed prototype of a Tudor Black Bay P01 watch – the designer here is exploring how an offset crown might look and feel.  
*Right:* a Tudor Caliber MT5601 movement on an assembly carousel

# The new



In an understated HQ in Geneva, Tudor is quietly transforming the way timepieces are assembled.

By Chris Hall  
Photography:  
Sam Chick



# process





# A

## visit to Tudor's headquarters in Geneva

is a visit to the heart of a paradox. For starters, there really is no such thing as "Tudor HQ". What there is, in a light industrial district to the south-east of central Geneva known as Les Acacias, is Rolex HQ: a number of glass buildings laid out over two city blocks.

The ten-storey factory buildings stretch out forbiddingly, clad in darkly tinted glass with taller blue-green tower blocks at the entrance. The whole site is surrounded by neatly maintained lawns and planted with trees of completely uniform height and size; flagpoles line the driveway and atop each of the main buildings is a large yellow crown logo, with Rolex in green letters ten feet tall beneath them. The rooftops are either covered in grass or solar panels. There isn't the slightest hint of another brand.

This will make complete sense to watch fans: Tudor was established in 1946 by Rolex founder Hans Wilsdorf to provide watches for customers not yet well-heeled enough to own a Rolex.

It is a paradox for modern-day Tudor, however; having gamely played the role of younger sibling for several decades, the product line-up grew stale around the turn of the millennium, and the Tudor that emerged into the light in 2010 following a three-year process of rebranding is no longer a scaled down sidekick but a company with a vivid identity all of its own. That makes not

having your own front door – let alone your logo on the roof – a bit awkward.

To many, Tudor's one-line pitch is still "Rolex quality at lower prices", and as selling points go, that's not at all bad. But the reality is that modern Tudor has made a distinct habit of doing things big brother won't, like limited editions and retailer collaborations, heritage revival models and working with materials such as bronze, ceramic and fabric straps. And once you do penetrate the exterior of this green and gold temple to find the red and black Tudor-branded zones within, you realise the two brands really are doing things differently at every step of the watchmaking process.

Sometimes, that's out of pragmatism: Tudor's value proposition makes it futile to attempt the kind of all-under-one-roof approach adopted by Rolex (which makes everything save for the hands and sapphire crystals, even going so far as to smelt its own metals). It buys in its dials, cases and bracelets as well as some movements; Tudor has been producing its own movements since 2015 but relies on third parties for some models – notably receiving chronograph calibres from Breitling in exchange for time-only movements. Tudor also takes a different approach from Rolex in managing its production: it says it builds everything to order.

The facilities at Les Acacias don't cover movement manufacture – the most complex and time-consuming part of building a watch. Instead, that takes place at a site elsewhere in Geneva (soon to move to Le Locle as part of a joint venture with Chanel). But it is where the watches are designed and tested, and it is home to the final assembly workshops.

At the heart of the operation is The Church. Not a statement of faith – this is the nickname for a vast, centralised vault of parts. A fully automated system that holds millions of components over five subterranean storeys, it can deliver the necessary box of bits to Tudor's assembly floor in less than a minute. The boxes arrive with the "train station" team, who manage the flow of parts in and out, and their distribution across the assembly room floor, where 60 technicians in



white coats are steadily turning them into watches. The coats, by the way, have fine metallic strips woven through them, which are given a low electrical charge to attract dust away from the watches.

Tudor's dedication to marginal gains is evident wherever you look. It follows Japanese industrial methods, such as the "5S" doctrine, which states that only the absolutely necessary tools should be used, and each has its own outlined space at every identical workstation. Every employee can switch places (signing into each desk with a fingerprint scanner) and find things exactly as they are used to. Another Japanese ideology, the "kaizen" principle of constant improvement and evolution, is embraced: little changes are made week in, week out, and a prototype workstation sits in one corner, ready to be rolled out across the floor.

Tudor invests heavily in aspects of production that are neither glamorous

*Top:* unlike its parent company Rolex, which produces a set amount of each of its watch models, Tudor's timepieces are only assembled once a customer places an order, so there is never any surplus stock





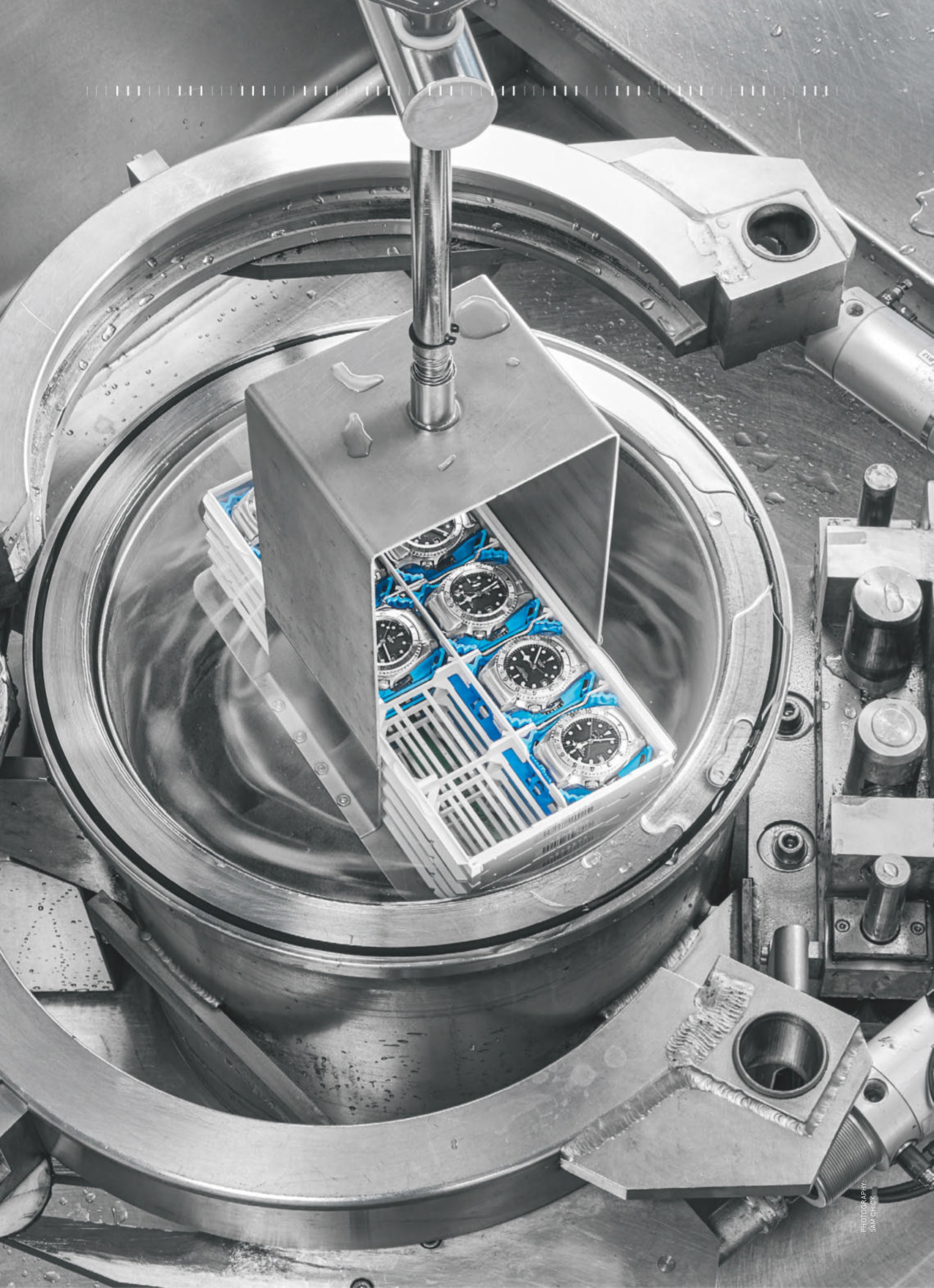
or photogenic: improvements that the customer will never feel – except, perhaps, when it keeps the price below that of its rivals. One such example is a machine commissioned especially for fitting hands to a dial – a critical procedure that can require six months’ training to perfect by hand, and can be a common cause of repetitive strain injuries. Tudor has a machine that switches between different models of watches on the assembly line, a task that used to take 30 minutes, but now takes 30 seconds. Or take the microphone developed to listen for the “click” as the date wheel of the movement rotates into position, or the torque winding tool for screwing in the crowns. Even the quality-control team have bespoke 3D-printed holders to work on the watches at a comfortable angle.

Once assembled, each watch is diligently tested. First by hand, on quality-control benches at the back of the room, where one of the main tasks is removing any human bias that may have crept in along the assembly line, which, it’s said, can account for differences in perception of up to five per cent in various different companies. The cased-up watch is checked for its accuracy – Tudor regulates both its in-house and outsourced movements to a daily standard of  $-2/+4$  seconds, a significant improvement on the COSC chronometer tests that the individual movements will already have passed.



Above: a member of the “train station” team prepares watch parts for distribution to workers around the assembly room. The components arrive here via an automated system









*Left:* a batch of watches prepares to undergo pressure testing in a hyperbaric chamber to at least ten per cent greater than their rating. *Above:* every Tudor timepiece is assembled in a 3D-printed cradle



And then there is the most important test: checking the watch's water resistance. Up to 100 watch "heads" – cased-up watches without straps or bracelets – are stacked in trays before being lowered into a hyperbaric chamber (a dustbin-sized tank full of water, with 5cm-thick reinforced steel walls) where they will be subjected to pressures beyond their stated depth ratings.

Regular models, typically water-resistant to depths of 100m, are tested to a further ten per cent of stated maximum, while dive watches (rated in excess of 300m) are tested to a further 25 per cent. Bronze-cased watches are only sent down in batches of ten, which Tudor says reduces the time spent in the water. Even though the brand uses aluminium bronze which is far more resistant to corrosion than ordinary bronze, you don't want the watch to begin its process of patination before it even reaches the customer.

Having submitted to these checks, each watch is dispatched to an underground chamber where it will spend three days being put through a fully automated series of tests. (It is common practice for Rolex's buildings to extend as far underground as above; among other things, they have their own customs office down there so that watches can be exported directly from the factory without the need for border checks.)

Very few watches fail a quality control check at this point, largely because every part is tested earlier in the lifecycle: we visit the R&D rooms where miniscule components (in this case, a single escapement pinion) are stress-tested to simulate ten years of life; crowns are pushed, pulled and turned, and the strength of the hands is assessed by using them to turn the movement, sending the force backwards through the watch.

Tudor also let us observe an aspect of its watches that's very rarely seen by journalists: the process of making its straps. Normally, even the top brands outsource this part, and they would be made almost entirely by machine. Tudor also outsources its straps, but in this case they are a cut above the rest and are the subject of much fascination from watch enthusiasts looking to take attention to detail to the next level.

*Below: besides its 150-year-old jacquard looms, Julien Faure also has these modern, computer-controlled ones. The neon yellow strands of the loom are made from Kevlar and allow for fine detail*



# W

**When Tudor bounced back in 2010,** it was decided that it would offer watches on fabric straps, arguably creating the wider trend in swappable straps and more casual looks. For this it turned to French textile studio Julien Faure, a family-owned firm near Saint-Etienne, in France's textile region. Since the renaissance, the towns around Lyon specialised in weaving ribbons and other narrow fabrics. Founded in 1864, Julien Faure still operates jacquard looms that are over 150 years old.

That's not to say there haven't been modernisations: Julien Faure was the first to computerise its design process in the 1980s – it couldn't find anyone to develop software for jacquard

looms, so it coded it itself, creating the number-one software package for textile weavers around the world.

Tudor approached in 2009 asking for a simple NATO-style fabric strap. They considered silk, but durability was an issue, and it still wasn't sufficiently impressive. After some thought, Tudor and Julien Faure settled on the idea of weaving the NATO strap – which normally consists of layers of fabric stitched together, with the spring bars between them – in a "monobloc" construction. It would comprise one single piece of fabric with the tunnels for each bar woven into it. The result would be something slimmer than anything else on the market, with fewer seams to fray, and the positioning of the bars would be more precise, meaning the watch would be less likely to slide around on the wrist.

The end result was patented. It uses 500m of yarn per strap, passes all of Tudor's resilience tests and takes around half an hour to weave. Once woven, the straps are sent to another company for cutting, perforating and edge finishing, as well as adding the metal buckles. From there, the finished straps are shipped to Tudor in Geneva, where they, like everything else, enter The Church, ready to be summoned to the assembly floor.



# DOXA

1 8 8 9



SUB 300 AQUAMARINE

[www.doxawatches.com](http://www.doxawatches.com)

THE  
**BLUE**  
COMPANY

LONDON

[info@thebluecompanylondon.co.uk](mailto:info@thebluecompanylondon.co.uk)

YOUR  
CALL  
TO  
ADVENTURE





## DIVE WATCHES

**Developed in the 1950s** as a means to track elapsed time underwater, the design brief of the dive watch was very simple: be accurate, be legible and don't leak. This led to a fairly standard form factor for their first two decades: white hands on a black dial, with a rotating timing ring.

Given this straightforward spec, watch brands have been left with either a very easy, or a very difficult task when they set out to create a new dive watch: hew close to the archetype, or get creative and stand out from the crowd. By the late 1960s and into the 70s, dive watches got funky, with colourful dials and bulbous cases – but still, they had to perform their primary task.

Digital dive computers have replaced analogue watches on the wrists of today's underwater explorers. This has freed watch companies from the constraints of a "function first" ethos, and has also coincided with advances in materials and manufacturing. This means that dive watches are, ironically, more capable than ever, with anti-magnetic movements and abyssal depth ratings, but can also embrace unconventional design.

DOXA, a Swiss stalwart founded in 1889, arguably reinvented the dive watch in 1967 with its SUB 300, a watch that sported a dual-scale timing bezel that indicated no-decompression times, an orange dial, and an oversized minute hand (tracking hours is not important underwater). For 2020, this retro classic has been given a contemporary overhaul, with DOXA's first case made from forged carbon.

While the form factor of a dive watch is its calling card, what's inside is just as important. Grand Seiko, the high-end arm of the Japanese watch giant, has fitted the newest generation of its Spring Drive movement inside the limited edition 60th Anniversary Professional Diver. Now with an extended power reserve, the movement mates a conventional geared drivetrain to an electrical impulse regulator for extreme



**Grand Seiko SLGA001**  
Case: titanium, 46.9mm  
\$11,100 [grand-seiko.com](http://grand-seiko.com)

accuracy. Grand Seiko has also introduced temperature compensation technology via a thermal sensor to improve accuracy even further, all to ensure you don't overstay your time in the octopus's garden.

Then there is arguably the most well-known dive watch, Rolex's Submariner, first introduced in 1953. The new Sub doesn't upend the aesthetic, but there are improvements. A new bracelet is a shade wider, while slimmer lugs conjure a vintage-style profile. The major upgrade is a new calibre (the 3230), complete with Rolex's Chronergy escapement and paramagnetic pallet fork and escape wheel, which increases reliability and boosts the power reserve to 70 hours – a 46 per cent increase on the 48 hours offered by the old movement.

# Guide



**Rolex Submariner**  
Case: Oystersteel, 41mm  
\$6,540 [rolex.com](http://rolex.com)



**DOXA SUB 300 Carbon**  
Case: carbon fibre, 42.5mm  
\$4,790 [doxawatches.com](http://doxawatches.com)



## 4

**There's a deeply held**

desire in the hearts of both watchmakers and buyers to categorise. This watch is for wearing with a tuxedo; this one for playing sports; this one for astronauting, and so on. In many cases – think professional-grade dive watches or military pilot's watches – these objects were born out of a particular need at a specific moment.

However, modern lifestyles require greater flexibility from watchmakers, and a new generation of watches has been emerging in which technical supremacy, deluxe styling and robust construction ensure the boundaries between use cases are well and truly blurred.

A. Lange & Söhne, a brand admired for its patrician, black-tie timekeepers, has recently embraced a more diverse approach than usual with the launch of the Odysseus. It packs Lange's customary horological punch with a distinct day/date display indicated through prominent windows either side of the dial, and assiduously hand-finished assemblies of gears and bridges underneath. But its sturdy case design and utilitarian (by the brand's standards) style mark the Odysseus out as a true all-rounder, whether in steel with a five-link bracelet, or in white gold with a silicone strap designed for active wear.

The generalist style goes out to sea with the Portugieser Yacht Club Chronograph from



**Omega Constellation Master Co-axial Chronometer 41mm**  
£5,220 [omegawatches.com](http://omegawatches.com)

IWC. The brand's flagship Portugieser line evolved from a 1930s original with a dial rooted in classical marine chronometers, though the sportier Yacht Club version has been around as a niche option since 2010. Now IWC has moved it front-and-centre, with an expanded collection that includes three versions available on a new, sturdy bracelet, mixing sportiness with luxury in the form of a two-tone version in steel and contrasting rose gold. It contains one of

IWC's most advanced in-house movements, Caliber 89361, a chronograph timer with additional flyback functionality (so timing can be reset without first being stopped) and a power reserve of 68 hours.

Largely left out of Omega's conversation in recent years has been the Constellation, its glossiest watch, which has now been upsized to 41mm, upgraded with the brand's high-tech Co-Axial Master Chronometer movement, and given a pick-and-mix of bracelet, strap and colour options. Those elements, and the streamlined, lug-free case design, make it a watch equipped for a life well lived. If the textured dial and flamboyant bezel – including the flanking "claws" that



**A. Lange & Söhne Odysseus**  
Case: white gold, 40.5mm  
€38,500 [alange-soehne.com](http://alange-soehne.com)

have been a hallmark of the design since 1982 – add a kind of decadence absent from Seamasters and Speedmasters, Omega's expertise in advanced materials science is never far away. The bezel, in gleaming scratch-proof ceramic, is seamlessly inlaid with numerals in the ultra-tough amorphous alloy Liquidmetal. But – is this a sports watch? Sort of... Is it dressy? Perhaps... Does it matter? Not one bit.



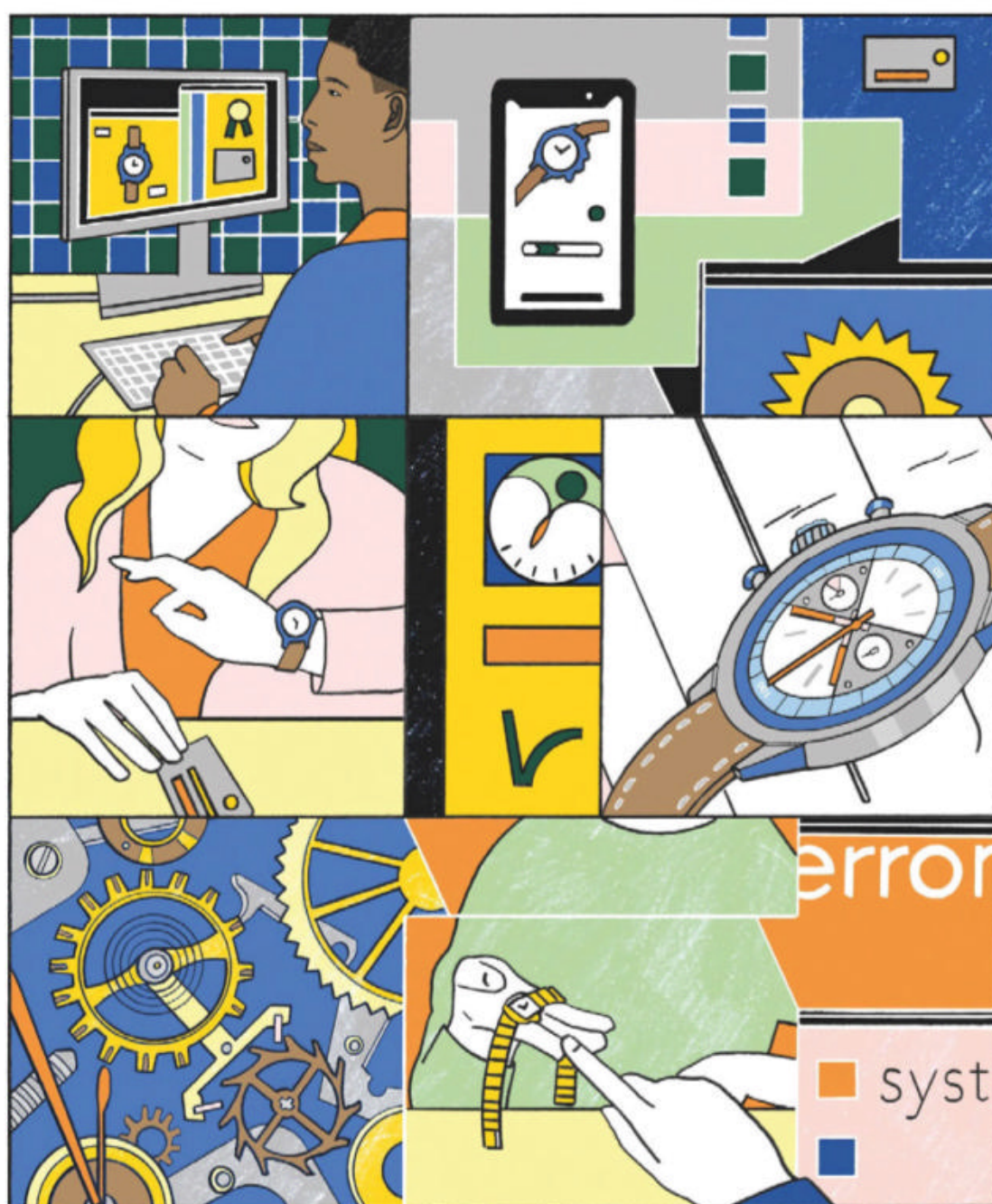
**IWC Portugieser Yacht Club Chronograph**  
£17,600 [iwc.com](http://iwc.com)

## FLEXIBLE FRIENDS



# Blockchain reaction

The indelible digital ledger is bringing robust authentication and transparency to the watch world. By Timothy Barber



**For a global business worth a reported \$17 billion and driven by increasingly sophisticated online platforms, the secondary – or “pre-owned” – watch market is constrained by a particularly analogue factor: when it comes to authentication of timepieces, dealers still rely on the warranty cards and paper certificates issued by manufacturers.**

Given that counterfeiters can now clone “super fake” watches with such sophistication that even experts can be duped, trusting mere paperwork for the authenticity of items is an increasingly dubious proposition.

But blockchain technology may offer a solution. The idea of using blockchain’s distributed ledger system to ensure fail-safe authentication and accountability is already being trialled everywhere from the art market and auction houses to financial services and music-rights management.

In the watch market, it offers the opportunity to create a fixed and immutable record for any timepiece, safeguarding transactions and devaluing counterfeits. More funda-

*Left: from ensuring authenticity to tracking purchases and parts, the blockchain could create an ecosystem of services tailored to each watch*



mentally, proponents argue it could transform the entire nature of watch ownership, as a watch's digital "identity" – and by extension, its connection back to the brand itself – remains secure and constant, even as the watch itself changes hands multiple times.

French entrepreneurs Guillaume Kuntz and Marc Ambrus launched Watch Certificate, a side venture to their online marketplace Tradee-watches, in the teeth of the Covid-19 lockdown. For between €99 and €299 (depending on the value of the watch), their service enables clients to put a piece through a detailed checking and authentication process. A physical steel card is then provided, bearing a QR code linked to a digital certificate secured in the blockchain. The checks themselves are carried out by watchmakers local to the client, selected by Watch Certificate, and validated by independent experts. Kuntz describes this as amounting to the creation of a passport for a luxury watch, one which can be viewed via a phone app.

"The certificate is a tamper-proof document, with 42 checkpoints and high-definition pictures including the movement and the serial number," Kuntz says. "For the buyer, it is a guarantee that the watch is real, but it also details the condition and authenticity of the parts, which is particularly useful in the vintage world where each part can have a strong impact on the overall value of the watch."

For newer watches, ultimate authenticity comes from the brand itself. Until recently there was little incentive for makers to engage with a pre-owned market they saw as fundamentally undermining their brand equity, but the relationship is becoming far more reciprocal. On the one hand, brands have been forced to grapple with a free-flowing grey market fuelled by the vast oversupply of watches made during the boom years. But more fundamentally, they are facing a clientele whose values are changing and who have little truck with tradition.

"By next year, Generations Y and Z will represent more than half of current luxury consumers, and they're generations that shop very differently," says Pierre-Nicolas Hurstel, co-founder and CEO of Arianee, a consortium that has developed an open-source protocol for creating "digital identities" for valuable items. "Luxury objects are increasingly seen as assets that not only keep or gain value, but are now more liquid. So authenticity, transparency, and being able to transfer it safely has become important."

Brands and luxury groups are waking up to blockchain's potential to aid a secure and legitimised industry in which the markets for new and pre-owned products effectively merge. LVMH, the world's biggest luxury group, has said that it is developing its own blockchain platform, though it has released no details. Its rival, Kering Group, has been working with another French startup, Woleet, to develop a blockchain-based warranty system that was unveiled in January with its high-end watch brand, Ulysse Nardin.

Each Ulysse Nardin watch now receives a digital warranty certificate anchored in the Bitcoin blockchain, in a package which includes a unique serial number, warranty card number and warranty end date, and the validity of each certificate can be checked via a widget on the brand's website. "We want to provide secured proof to our end customers, and thus create trust as regards the authenticity of

all our products," explains Patrick Pruniaux, Ulysse Nardin's CEO.

"The second step in this deployment will cover the transfer of ownership of the certificate. Also, why not eventually have a record of all the maintenance operations on our watches in the blockchain?" Pruniaux says.

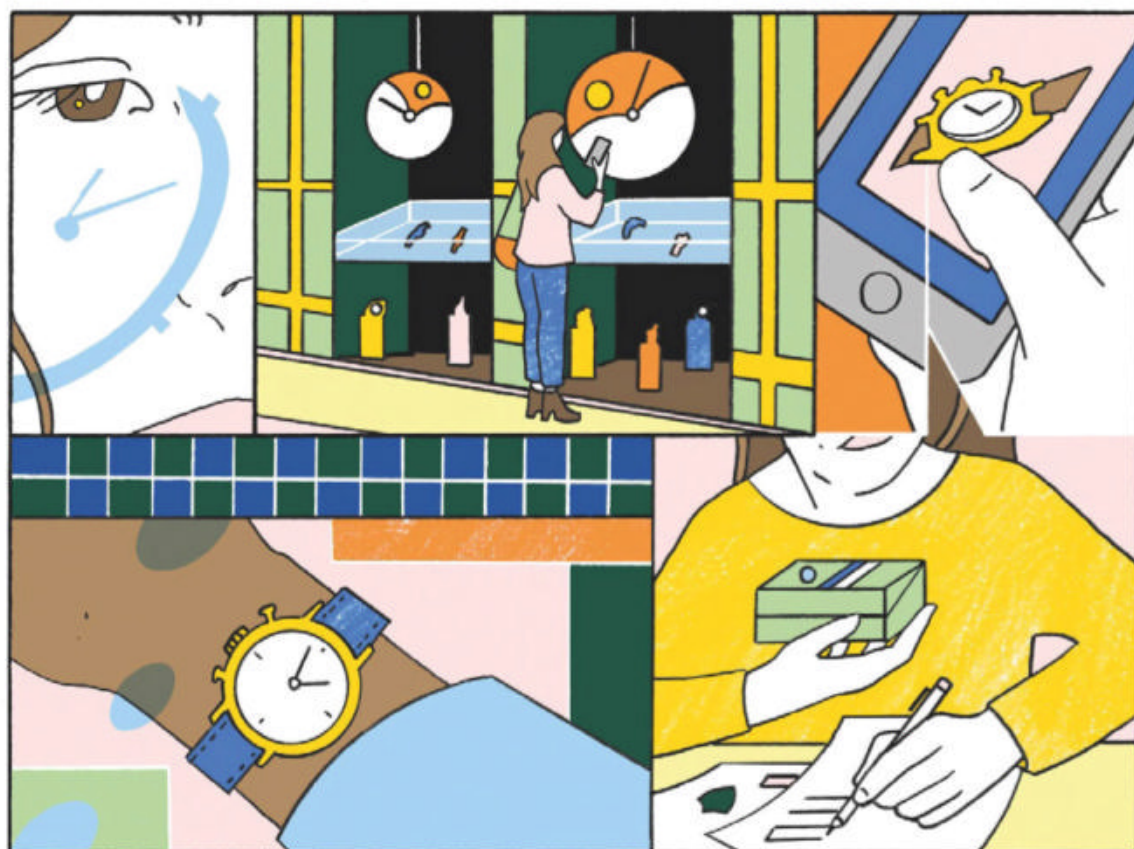
Why not, indeed? The possibility of implementing additional services is propelling interest around Hurstel's Arianee platform, whose open-source setup allows for exactly that. Since mid-2019, Vacheron Constantin has been piloting it for its "Les Collectionneurs" project of restoring and selling its own vintage watches, which now come with digital certification.

And in February, Breitling, among Switzerland's largest independent watchmakers, announced the launch of the first brand new wristwatch, a fashionably retro limited edition "Top Time" chronograph, with authentication backed by the Arianee protocol. This provides an e-passport containing "a digital, inalterable and augmented identity" for each individual watch, as well as a function allowing the legal transfer of the digital identity to a new owner, while preserving its track record.

A further opportunity is that third parties, or brands themselves, can build in additional services using the protocol. These could range from managing servicing and warranty extensions to loyalty programmes and special events, and even facilitating resale, all managed in privacy via the Arianee wallet.

'The blockchain is a guarantee that the watch is real, but it also details the authenticity and condition'



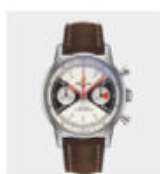


'Generations Y  
and Z will represent  
more than half of  
luxury consumers  
– and they shop  
very differently'

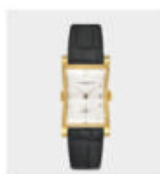
**Ulysse Nardin  
FREAK X MAGMA**  
Case: carbon fibre/resin  
CHF 27,000  
[ulyse-nardin.com](http://ulyse-nardin.com)



**Breitling Top Time  
limited edition**  
Case: steel, 41mm  
Strap: leather  
£4,100 [breitling.com](http://breitling.com)



**Vintage Vacheron  
Constantin Ref. 4591**  
Case: yellow gold  
Strap: leather  
£9,125 [chrono24.co.uk](http://chrono24.co.uk)



Above: the blockchain enables each watch to be tracked from original purchase to selling to a new owner

"Brands struggle with needing to know their customer more, but also respecting their privacy, which is so important in luxury," Hurstel says. "This proposes a more circular experience. You can enjoy services and experiences through the product you own, and then sell it safely and easily."

A glance at the membership list of the consortium which collectively owns and has access to the Arianee technology reveals how seriously its possibilities are being taken. Besides Breitling and Vacheron Constantin, watchmakers including Audemars Piguet, MB&F, Roger Dubuis and Manufacture Royale are all present. And most strikingly, so too is Richemont Group itself – owner not just of Vacheron Constantin, Cartier and an array of high-end Swiss marques, but of luxe e-commerce behemoth Yoox Net-a-Porter, and the major pre-owned platform, Watchfinder. Hurstel says more big players are waiting in the wings: "Things are suddenly going faster."

Transparency will likely be blockchain's other significant innovation for Swiss watchmaking's famously

closed shop. In the fashion industry, the technology has long been touted as a means for driving ethical and sustainable supply-chain practices and encouraging openness from brands. The same is potentially true in the watch industry, where the "Swiss Made" label has become a subject of both controversy and opaque efficacy.

Breitling CEO Georges Kern, who plans to roll out the technology across the brand's portfolio, sees this as a crucial factor. "Blockchain is something we are going to face everywhere in ten to 15 years – you'll be able to understand where the cotton in your shirt was collected, and what factory it was produced in, and not only will you know, but you'll want to know," he says. "This transparency will be there both in the source and in the life of the product. The next step will be to extend it to the whole supply chain."

The change to know how much of a watch is really made in-house, or indeed in Switzerland, would make the blockchain transformative not just for the way watches are sold or owned, but the way they're made, too.



# Simply Better

**Sustainable. Iconic. Original.**

## The essence collection

Innovation and sustainability - right on time. The essence collection reinterprets the original design of the Official Swiss Railways Clock with a modern twist. Eco-friendly materials are used in the case, strap and packaging. Mondaine watches become items of iconic self-expression using oil from the wonder tree, cork and recycled PET.



Find out more about the essence collection  
on [www.mondaine.com](http://www.mondaine.com)





Using photoluminescent material to show the time in low-light conditions is a practice that has been employed since the development of the earliest wristwatches. Originally, riskily radioactive radium and then tritium were the substances of choice, but thankfully we now have safer options such as H3 tritium gas and strontium aluminate. The most common hues are green, blue and white, but watchmakers are branching out into a rainbow of colours that are topped up by sunlight and release their energy after dark. From the deep sea to the dancefloor, the love affair with luminescence isn't fading away.

# 01

**ROLEX GMT-MASTER II**  
This 40mm Oystersteel and "Everose" gold watch with a black dial and a brown and black Cerachrom bezel simultaneously shows the time in two different time zones during intercontinental flights – but it's the use of Chromalight that really shines out. Rather than green, Rolex's proprietary compound glows a vivid blue in the dark. Rolex claims that Chromalight can last up to eight hours, more than double the time of other luminescent materials.  
£11,850 [rolex.com](http://rolex.com)

# After



## 02

Watchmakers get their glow on with the latest low-light dazzlers. By Tracey Llewellyn & Jeremy White. Photography: James Day

ZENITH DEFY 21  
CARL COX EDITION  
By day, the limited-edition Defy 21 Carl Cox is a technical-looking, 44mm carbon-cased, skeletonised chronograph. But by night, it delivers an aesthetic straight out of late-80s rave culture – complete with a running seconds sub-dial that takes the form of a spinning vinyl record. As well as the hands and indices, the carbon-fibre bezel and strap stitching also glow in the dark.  
\$19,100 [zenith-watches.com](http://zenith-watches.com)

# dark





## 03

**BELL & ROSS BR03-92  
DIVER FULL LUM**

Bell & Ross has reversed the traditional principles of day and night legibility by coating the entire dial of its 42mm Diver Full Lum with green Superluminova C5, and the indices and bezel numerals with yellow Superluminova C3. On the sensible side it has a 38-hour power reserve, water resistance to 300 metres, and woven black rubber or resilient black synthetic fabric straps – but it's that in-your-face all-over lume treatment that makes this a righteous wrist-dazzler. £3,800 [bellross.com](http://bellross.com)





## 04

BALL WATCH CO.  
ENGINEER III MARVELIGHT  
CHRONOMETER

According to Ball watch, its self-powered micro tubes are 100 times brighter than standard luminous coatings. H3 tritium gas is safety-sealed in mineral

glass tubes that are coated with a luminescent material – and nowhere is their light brighter than on the recent Engineer III Marvelight. With rainbows now a symbol

global fight against Covid-19, Ball has issued a limited-edition 40mm watch with multi-coloured gas tubes. For every “Caring Edition” sold, 300 Swiss Francs will be donated to The Salvation Army. £1,800 [ballwatch.com](http://ballwatch.com)





**First introduced in 1932, Patek** Philippe's Calatrava – a round, gold wristwatch exhibiting Bauhaussian levels of simplicity – tends to be held up as the embodiment of Swiss watchmaking at its purest. Which made the new Calatrava announced in June something of a surprise. Cased in stainless steel instead of a more formal precious metal, and with a sporty fabric-effect strap, its blue dial pops with concentric circles, cross-hatch engraving, thick-cut hands and numerals that fan out from the centre.

Made as a limited edition to mark the opening of Patek's new Geneva factory – and, due to pandemic-induced postponements, the only new wristwatch the brand had announced by the year's halfway point – its colourful blurring of formal and casual, sporty and classical, hits watchmaking's zeitgeist dead on. Whether by accident or intention, it is a Patek Philippe for the Instagram generation.

The latter platform has become a dominant force in the watch industry. "It's the most influential marketing platform," says David Sadigh, CEO of the Digital Luxury Group, a communications agency based in Geneva and New York. "For aficionados, collectors, fashion enthusiasts – and therefore for the brands themselves – it's critical."

Watch brands now communicate on Instagram with followers in their millions, amid an ecosystem of specialist collectors, commentators, startups, dealers, enthusiasts and, inevitably, influential trolls. Omega's

2017 launch of its "#SpeedyTuesday" limited edition, a watch inspired by a hashtag used by collectors who took to posting pictures of Omega Speedmasters on Tuesdays, was a watershed moment: the watch, announced on Instagram (on a Tuesday, of course), sold out in a matter of hours.

Audemars Piguet's launch of its Code 11:59 line in January 2019 was arguably another: a long-planned bid to add new direction to a brand bound by a single iconic design, the Royal Oak, the Code 11:59 was received with a torrent of Insta-driven opprobrium. It didn't help that the watch's aesthetic complexities – glass that curves in two directions, and a highly architectural case displaying multiple styles of finish – simply didn't translate on-screen.

"It's pretty hard to photograph complicated things, or very high horology," says Kristian Haagen, a collector and influencer with 122,000 followers and two books published of his Instagram watch imagery. "It's all about getting that very instant hit."

'Instagram is the most influential marketing platform. For aficionados, collectors and the brands, it's critical'

Perhaps it should be little surprise that the watch world has undergone a colour explosion in the past two years, alongside a loosening of once-rigid codes around style. Not long ago, the appearance of a blue watch dial was considered newsworthy (and it still is for Patek Philippe); now dials in rich greens, crimson, brown and purple, often heightened by textures and gradients, are increasingly the norm.

Oris's latest twist on its retro-influenced Divers Sixty-Five could make it the perfect Instagram watch. The brand partnered with the high-end

# Instant approval

The Instagram effect has introduced quirky watches designed to be more impactful on social media. By Timothy Barber



Japanese denim label Momotaro for a version that mixes a weathered green dial, "vintage" beige hour markers, a bronze bezel with black insert, and a strap in Momotaro's indigo denim.

TAG Heuer's Autavia Calibre 5 collection, which launched in January with dials in bold gradients of blue, grey, green and brown, reflected not just this chromatic shift, but the fact that brands have taken to unveiling entire collections of colour variations at once, offering the greatest flexibility to their customers while peppering marketing channels with diverse versions of a new model.

"People buying a watch today are buying it for deeper reasons than 'everybody needs a watch', and colour and texture go a long way towards that," says TAG Heuer's creative director Guy Bove, who also acknowledges the cross-pollination of influences enmeshed in the social media feed. "I've noticed a lot of people posting vintage watches that have faded and changed in particular ways, and that's introduced new colours like brown, green and brass that people are suddenly used to seeing on a watch."

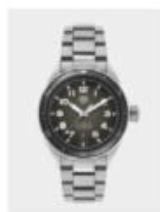
**Patek Philippe**  
**Calatrava Ref 6007A**  
limited edition  
Case: steel, 40mm  
Strap: calfskin  
£21,710 [patek.com](http://patek.com)



**Oris X Momotaro**  
**Divers Sixty-Five**  
Case: steel and bronze, 40mm  
Strap: indigo denim  
£1,700 [oris.ch](http://oris.ch)



**TAG Heuer**  
**Autavia Calibre 5**  
Case: steel and ceramic, 42mm  
Strap: steel or leather  
£2,595 [tagheuer.com](http://tagheuer.com)



As one Swiss brand CEO put to WIRED, the visual proliferation of a once-exclusive and solemn world is appearing to drive a kind of aesthetic arms race among brands of every size. "It's a way of getting out of this tepid visual soup where everything looks the same," he says. "If you want to bring in fun, emotion and pleasure that's rooted in the present, you need this."

However, as is the case with Instagram's curated stream of filtered perfection, the little square only tells a part of the story. As Sadigh points out, for most brands only a portion of the clientele will ever be on the platform, and only certain watches deliver that instant sugar hit successfully.

Nevertheless, the shift in emphasis towards full-blooded designs that suit a different kind of buyer is palpable. "The customer base of a lot of these brands was getting too old," Sadigh says. "They want to rejuvenate, and when you go outside traditional clients, you go towards fashion and visual culture. The watches are reflecting that."

*Below: Instagram's young influencers prefer timepieces with visual flair*

ILLUSTRATION: CATHAL DUANE





# WIRED

## ONE YEAR ALL ACCESS

# PRINT + DIGITAL



# ALL FOR ONLY £19\*

FREE INSTANT ACCESS TO THE DIGITAL EDITIONS.  
ALL YOU NEED IS YOUR SUBSCRIPTION NUMBER.

\*LIMITED TO UK ADDRESSES. FOR OVERSEAS ALL ACCESS ONE  
YEAR SUBSCRIPTION THE RATE IS £48 TO EUROPE OR US  
OR £58 TO REST OF WORLD. OFFER CLOSES ON 31/12/2020

[WIRED.CO.UK/SUBS/CWR19692](https://www.wired.co.uk/subs/cwr19692)  
0844 848 5202 REF: CWR19692



# Inner works



Piaget is at the razor-thin cutting edge. By Alex Doak

As there is a sole watchmaker charged with assembling each and every Altiplano Ultimate Concept leaving Piaget's doors, this craftsman has a great responsibility. The world's thinnest mechanical wristwatch may have only 167 parts, compared to the 269-part tourbillons and 407-part minute repeaters his colleagues contend with, but ultra-thin watches featuring nothing more than the hours and minutes qualify as extreme complications in their own right.

The Piaget Ultimate Concept first launched as a show-stealing proof-of-concept in 2018, and is a 2mm-thick piece that's unlikely to be trumped in thinness any time soon – even by the Roman jeweller Bulgari, whose recent records include the world's slimmest tourbillon.

Piaget took steps toward ultra-slim in 2014 with the 900P movement, which it mounted on the inside surface of the case-back, rather than on a separate baseplate, shaving off precious mm. (Though it should be noted that this solution was devised 37 years ago, in Swatch's revolutionary injection-moulded watch from 1983.)

This year's 900P-UC is 1.65mm thinner than the 3.65mm thick 900P, thanks to the movement baseplate, case-back, case ring and crowning bezel all being CNC-milled from a single piece of rigid cobalt alloy.

Then there's the balance wheel which now "floats" within a recess in the back plate, oscillating on ball bearings. The winding crown, whose crown-shaped pinion usually meshes perpendicularly (and bulkily) with a

Piaget Altiplano  
Ultimate Concept 900P-UC  
£poa [piaget.com](http://piaget.com)

gear connected to the barrel has been replaced with a worm gear, driving the barrel on a single plane, saving further space. Rather boldly, the crown itself is bar-shaped, stowing flush with the side of the case when not in use.

The Ultimate Concept is £poa, but reported to be priced well north of CHF 300,000, and each one is made to order by Piaget, so you're unlikely to run into someone else wearing the same. But for those wishing to guarantee absolute individuality, Piaget is offering a customisation service for the watch, with 10,000 possible permutations of baseplate finish, bridge colour, hands and strap.





MIDO Ocean Star  
Decompression Timer  
1961 Limited Edition  
£870 [midowatches.com](http://midowatches.com)

# Timely releases

The watch fairs may not have been in-person, but there are still plenty of new launches to get excited about. By Jeremy White



Patek Philippe Ref. 5303R-001 Minute Repeater  
Tourbillon £9000 [patek.com](http://patek.com)



Omega Seamaster Diver 007  
£7,390 [omegawatches.com](http://omegawatches.com)



Longines Spirit Pilot  
£1,650 [longines.com](http://longines.com)



Montblanc 1858 Automatic  
24H £2,575 [montblanc.com](http://montblanc.com)



Junghans Max Bill MEGA  
Solar £880 [junghans.de](http://junghans.de)





Breitling Endurance Pro  
£2,450 [breitling.com](https://www.breitling.com)



Audemars Piguet Royal  
Oak Offshore Self-winding  
Chronograph £34,000  
[audemarspiguet.com](https://www.audemarspiguet.com)



Sinn U50  
€2,170 [sinn.de](https://www.sinn.de)



Seiko Urban Safari Street  
Series £460 [seikowatches.com](https://www.seikowatches.com)



Rotate North Atlantic  
£295 [rotatenorth.com](https://www.rotatenorth.com)



Jaeger-LeCoultre Master  
Control Memovox £13,900  
[jaeger-lecoultre.com](https://www.jaeger-lecoultre.com)



IWC Portugieser  
Yacht Club Moon & Tide  
£30,800 [iwc.com](https://www.iwc.com)

Urwerk EMC Time  
Hunter Desert Sage  
€107,000 [urwerk.com](https://www.urwerk.com)



Audemars Piguet [Re]Master01  
£51,800 [audemarspiguet.com](https://www.audemarspiguet.com)







Panerai Luminor Marina  
Fibratex £17,100 [panerai.com](http://panerai.com)



A. Lange & Söhne  
LANGE 1 TIME ZONE  
€49,200 [alange-soehne.com](http://alange-soehne.com)



Rado True Thinline Anima  
£2,670 [rado.com](http://rado.com)



Ressence Type 1  
Slim X £17,650  
[ressencewatch.com](http://ressencewatch.com)



Tudor Black Bay  
Fifty-Eight Navy Blue  
£2,520 [tudorwatch.com](http://tudorwatch.com)

Despite Covid-19's  
disruption, global  
watch releases have  
had many highlights



Bremont MBII 2020  
£3,995 [bremont.com](http://bremont.com)



Garmin MARQ Golfer  
£1,699.99 [garmin.com](http://garmin.com)





**BREMONT  
PROJECT  
POSSIBLE**  
14 PEAKS / 7 MONTHS



# The horological equivalent of a stiff upper lip.

In 1953, stubborn pluck, a fair bit of planning, and British engineering helped get men to the top of Everest for the first time. Tents tested in the wind tunnel at Farnborough, jackets made in Manchester, wristwatches from Bishop's Cleeve.

2019 saw one man achieve the impossible and prove that kit from Old Blighty is still standard equipment for the roof of the world. Consider the Bremont Project Possible which celebrates the mountaineering feat completed by Nirmal "Nims" Purja who summited the world's 14 highest peaks, all over 8,000m, in just 6 months 6 days – smashing the previous record of nearly 8 years.

Built in Henley-on-Thames, the titanium and bronze case houses a chronometer-rated movement and its rotor details the heights of each of the 14 mountains in the order that Nims summited them. Limited to only 300 pieces, the Bremont Project Possible is engineered to survive the harshest places on earth. While tents and jackets may now be manufactured in any corner of the globe, there's still no substitute for a proper British timepiece.



**BREMONT**

CHRONOMETERS



British Engineering.  
Tested Beyond Endurance.





PATEK PHILIPPE  
GENEVE

BEGIN YOUR OWN TRADITION



YOU NEVER ACTUALLY OWN A PATEK PHILIPPE.  
YOU MERELY LOOK AFTER IT FOR THE NEXT GENERATION.

WORLD TIME REF. 5230G

PATEK.COM



